



Clinical outcome of cats with suppurative otitis media and intact tympanum submitted to myringotomy: retrospective findings from 26 cases

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Abstract

Case series summary The efficacy of medical treatment associated with single myringotomy in cats with suppurative otitis media (OM) and intact tympanum was retrospectively evaluated. Patients' records were retrieved from cats with suppurative OM. Cats were included in this retrospective study based on fluid content within the tympanic cavity on imaging, intact tympanum on otoendoscopic examination and neutrophils on ear bulla exudate cytological examination. A total of 26 cats with middle ear suppurative otitis were included. Just over half of the cats (54%) presented bilateral involvement. Clinical signs included head tilt (13/26), otalgia (9/26), Horner's syndrome (7/26), external ear discharge (5/26), and nystagmus and facial paralysis (1/26). Cocci were identified on cytological examination in 18/40 samples and rods in 2/40. Bacterial culture results were positive in 15/40 samples, with *Pseudomonas* species (4/15), *Pasteurella multocida* (3/15), *Staphylococcus felis* (3/15), *Staphylococcus schleiferi* (2/15), *Staphylococcus canis* (2/15), *Escherichia coli* (2/15), *Staphylococcus pseudintermedius* (1/15) and *Serratia marcescens* (1/15) isolation. After myringotomy and gentle flushing of middle ear bullae (0.5–2 ml saline per ear), all cats were treated with oral corticosteroids and a 1-month course of systemic antibiotics according to sensitivity testing. In total, 19 (73%) cats were clinically healed 60–240 days after treatment. One cat was euthanased because of failure to eradicate a *Pseudomonas* species infection. Another cat died a few hours after the procedure. The five remaining cats were cured after ventral bulla osteotomy.

Relevance and novel information OM without an aural polyp is a frequent diagnosis in cats, but data on medical treatment are scarce. This simple therapeutic technique, single myringotomy procedure and mild ear flushing, offers a practical, safe and efficient first-line treatment of suppurative OM with an intact tympanum in cats with or without neurological signs.

Keywords: Myringotomy; otitis media; clinical outcome; diagnosis

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Introduction

Otitis media (OM) is frequently diagnosed in cats; however, data on medical treatment are scarce except for polyp-associated OM.^{1–6} The reported literature recommends numerous abundant ear flushing with antiseptic solution, antibiotics with or without corticosteroids infused once a week or more, flushing after bulla septum fenestration and ventral bulla osteotomy.^{7–12} One retrospective study suggested that non-polyp-related OM can be successfully managed medically using either topical products, systemic antimicrobials or a combination.¹

In accordance with this therapeutic approach, 26 cases of suppurative OM without polyps and with a closed tympanic membrane, confirmed through cross-sectional imaging (CT or MRI) and cytological examination, were

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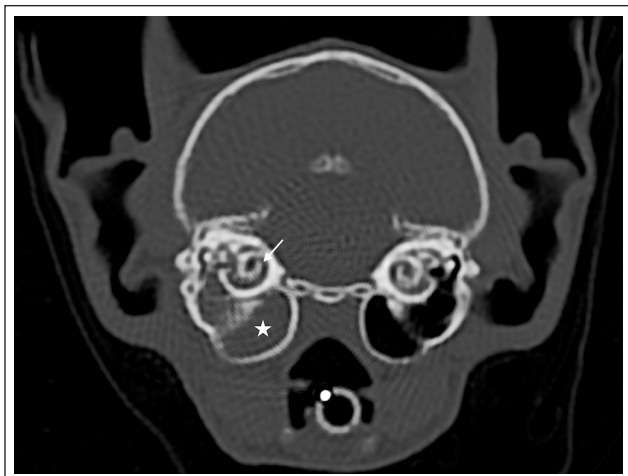


Figure 1 Transverse CT scanner of the head of a cat at the level of the tympanic bullae and cochleae obtained with a bone algorithm. The right tympanic bulla is fluid-filled (white star), with an intact wall. The bony structures of the cochlea are normal (white arrow)

retrospectively studied to assess the efficacy and safety of the procedure.

Case series description

Animals

Data were retrospectively collected from two different private referral centres in France using the same management procedures for OM (anaesthesia, imaging, myringotomy, treatment). The research was carried out between 2018 and 2020.

Retrospective information collected from the medical records included signalment, history, treatment before and after referral, neurological and dermatological examination reports, MRI or CT findings, and cytology and bacteriology results from the affected ears and outcomes.

The inclusion criteria were as follows: fluid accumulation within tympanic cavity on CT or MRI (Figures 1 and 2), intact tympanic membrane on both ears at otoscopy examination (Figures 3 and 4) and neutrophils on cytological examination of bulla exudate.

Anaesthesia

During this period, anaesthesia for cats undergoing CT and MRI was performed using the following protocol: cats were sedated using an intramuscular (*vastus lateralis*) injection of midazolam (0.2–0.3 mg/kg, Midazolam 5 mg/ml; Viatrix Santé), butorphanol (0.2–0.3 mg/kg, Torbugesic Vet 10 mg/ml; Zoetis) and dexmedetomidine (0.005–0.01 mg/kg¹, Dexdomitor 0.5 mg/ml¹; Zoetis). Anaesthesia was induced by intravenous administration of propofol, titrated to effect (1–2 mg/kg¹, Propovet

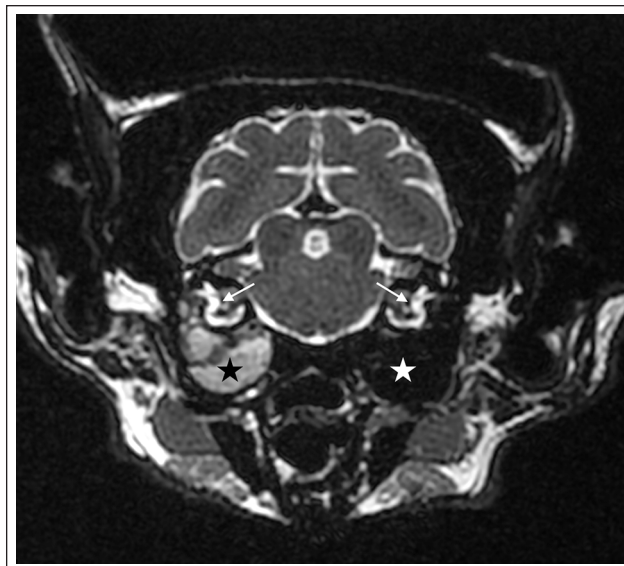


Figure 2 T2-weighted transverse MRI of the skull at the level of the tympanic bullae and cochleae. The right tympanic bulla is fluid-filled marked by a hyperintense signal on T2 (black star). The left tympanic bulla remains air-filled with a lack of signal (white star). The endolymph of the internal ears appears with a normal bright signal on T2 (white arrows)

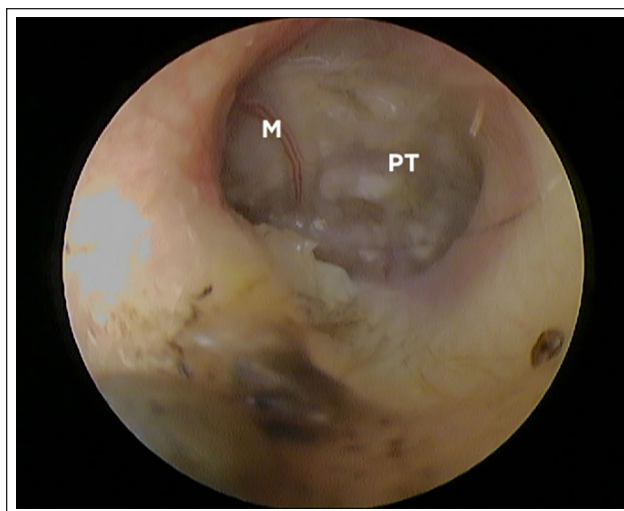


Figure 3 Otoendoscopic aspect of left tympanic membrane of a cat with suppurative OM. Heterogeneous pus is visible through the pars tensa. All cats with suspected or identified neoformations (ie, polyp, tumour) in the ear meatus or middle ear, tympanic perforation or non-inflammatory cytology were excluded. M = handle of malleus; PT = pars tensa

10 mg/ml; Zoetis). Maintenance was performed by an adjustable percentage of isoflurane in 95% oxygen diluted (Isoflurane-inspired concentration approximately 2%, Vetflurane; VIRBAC). Myringotomy practice was systematically followed by postoperative analgesia through

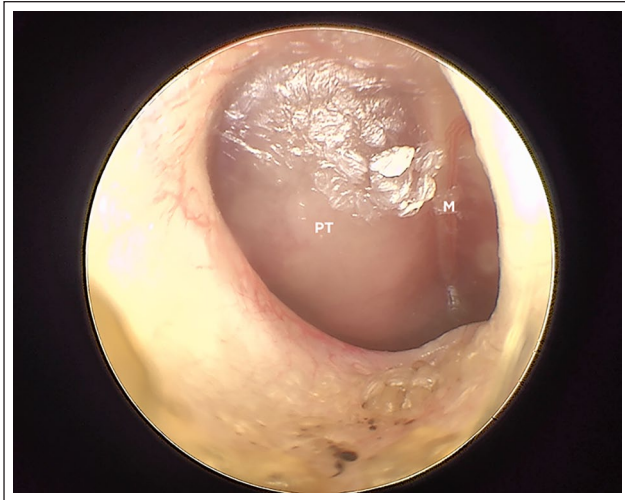


Figure 4 Bulging tympanic membrane of the right ear of a cat with suppurative otitis media. Exudate is visible through the membrane. M = handle of malleus; PT = pars tensa

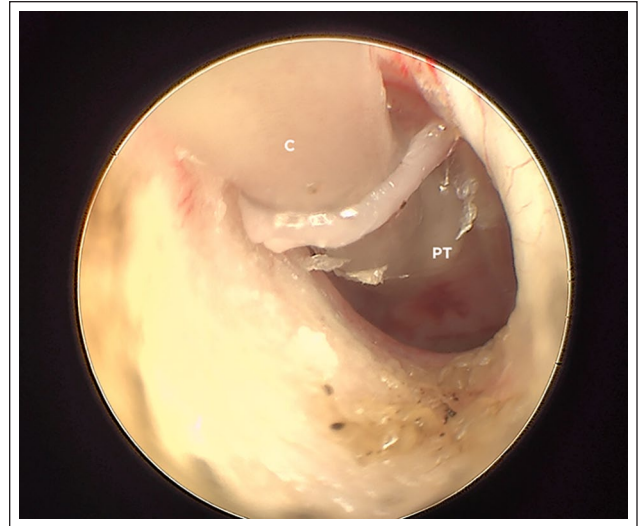


Figure 5 Myringotomy of the right ear with a rigid polypropylene catheter with a diameter of 2 mm. Aspiration of middle ear material. C = catheter; PT = pars tensa

a subcutaneous injection of buprenorphine (10–15 µg/kg SC, Bupaq; VIRBAC).

Myringotomy

If the proximal portion was obstructed by a ceruminous plug, the meatus was irrigated with peroxidised cerumenolytic solution (Otoprof; ICF). The plug was then extracted using sterile saline solution forced irrigation and the meatus was abundantly rinsed and then dried using suction.

A sterile, rigid polypropylene catheter with a diameter of 2 mm was cut at an angle of 60° with an incision blade providing a sharp point. This catheter tip was advanced under good visualisation using an otoendoscope and the caudal pars tensa was punctured (Figure 5).

Tympanic bulla contents were immediately gently aspirated. The catheter was removed and the contents were submitted for cytology, bacterial culture and antibiotic sensitivity.

The catheter was replaced in the tympanic cavity and 0.5–2.0 ml of sterile saline solution were injected and immediately aspirated.

Cytology

The sample was placed onto a slide glass and smeared with an additional slide, dried, fixed and stained using a modified Romanowsky-type rapid staining solution kit (RAL555, RAL).

Bacterial and fungal culture and sensitivity

Sterile swabs with liquid Amies culture medium were used and sent to the same laboratory under refrigerated conditions (Cerba Vet) for aerobic and

anaerobic bacterial culture and fungal culture. Antibiotic susceptibility testing was performed by disk diffusion on Mueller-Hinton culture medium and Mueller-Hinton supplemented with 5% blood depending on the bacteria species.

Medical treatment

As a postoperative procedure, patients received dexamethasone disodium phosphate injection subcutaneously after the procedure (0.1 mg/kg, Dexadreson; MSD). Prednisolone was prescribed the next day (1 mg/kg PO q24h) for 7 days. Antibiotics were prescribed initially according to cytological bacteria morphology: amoxicillin/clavulanic acid 12.5 mg/kg PO q12h (Kesium; CEVA) for cocci or lack of bacteria and marbofloxacin 2 mg/kg PO q24h (Marbocyl; Vetoquinol) for rods. The prescription was then adapted according to bacterial culture and antibiotic sensitivity. Antibacterial therapy was maintained for 30 days.

Follow-up

The cats' follow-up was carried out through physical examination for the first 3 months and later through telephone calls. Clinical examination included neurological examination and otoendoscopy (Figure 6). For economic reasons, CT or MRI were rarely performed at check-up visits.

Animals

A total of 26 cats met the inclusion criteria between 2017 and 2021 (54% had bilateral OM) (Table 1).

The median age of cats was 6 years (range 3 months to 13 years). There were 14 females (three intact, 11 spayed)

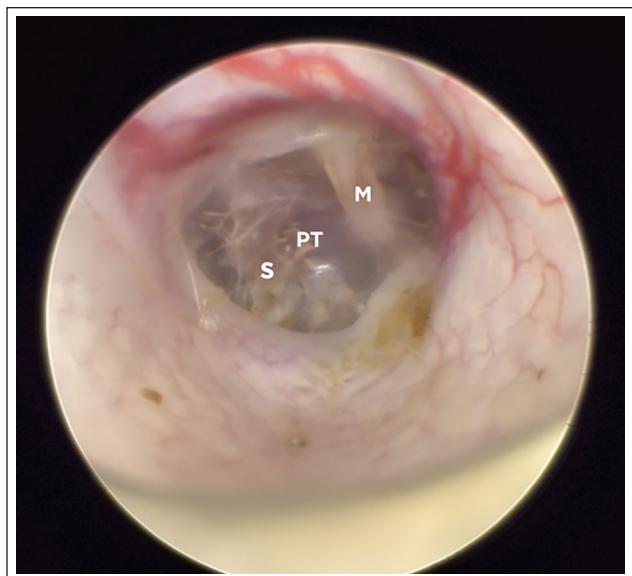


Figure 6 Otoendoscopic aspect of the tympanic membrane of the right ear of a cat 4 weeks after myringotomy. Large fibrotic scar on the caudal part of the pars tensa. M = handle of malleus; PT = pars tensa; S = scarce

and 12 males (three intact, nine castrated; male:female ratio = 0.86).

The most common breed of cat was domestic shorthair (15/26, 57%), followed by Sphynx (n = 4), Maine Coon (n = 3), Birman (n = 2), Persian (n = 1) and Abyssinian (n = 1).

Clinical signs

The most commonly presented signs were neurological signs (15/26), otalgia (9/26) and external ear discharge (5/26). Dermatological examinations were otherwise normal in all cats.

Neurological signs included head tilt (13/26) (Figure 7), Horner's syndrome (HS; 7/26) and facial paralysis with horizontal nystagmus (1/26). Clinical examinations confirmed peripheral vestibular syndrome in all cases of head tilt and HS.

Otalgia was identified on palpation of the submandibular area in 7/26 cats. Erythematous otitis externa was observed in 4/26 cats and proximal ceruminous ear plugs without external otitis in another 4/26 cats.

Imaging

Out of 26 cats, 22 (85%) had a CT examination. Fluid attenuation within the tympanic cavity was observed in all cases. Irregular periosteal proliferation was noticed in six cases and tympanic bulla partial lysis in four cases. Four patients had an MRI examination rather than a CT scan, of which 100% showed enhanced material in the bullae. No cat had evidence of otitis interna nor meningitis.

In total, 14 cats showed bilateral OM. Both tympanic bullae compartments, on each side of the bony septum, were affected in almost all cases (92.5%).

Otoendoscopy

Out of 40 affected ears, only 23 (57%) showed evidence of post-tympanic exudate: both bulging and opaque (12/40), opaque (10/40) and bulging (1/40) tympanic membranes (Figures 3 and 4).

Cytology

Microscopic cytological evaluation identified degenerated neutrophils on diagnostic samples (n = 40) with activated macrophages in 13/40 samples. Cocci were identified in 18/40 (45%) smears and rods in 2/40 (5%) smears (Table 2).

Bacterial culture

Bacterial culture was positive in 15/40 (37%) ear samples, with *Pseudomonas* species (4/15), *Pasteurella multocida* (3/15), *Staphylococcus felis* (3/15), *Staphylococcus schleiferi* (2/15), *Streptococcus canis* (2/15), *Escherichia coli* (2/15), *Staphylococcus pseudintermedius* (1/15) and *Serratia marcescens* (1/15) isolation. Of the 15 positive samples, a single bacteria species was isolated in 87% of cases and a combination of bacteria in 13% of cases. No resistance to initially prescribed antibiotics was noticed. All strains were sensitive to common antibiotics that are usually effective on each species, including *Pseudomonas* species and *Serratia* species, both sensitive only to fluoroquinolones.

Treatment

All 26 cats were treated with antibiotics and prednisolone (7 days). Clavulanate-potentiated amoxicillin (13–25 mg/kg PO q12h) for 1 month was used in 24/26 cats. The remaining two cats were treated with marbofloxacin (2–2.5 mg/kg PO q24h) for 1 month for *Pseudomonas* species and *Serratia* species infections.

Outcomes

In total, 19 (73%) cats were clinically healthy 60–240 days after the start of treatment, with full healing of the tympanic membrane at the 4-week checkup. One of the 19 cats still had an attenuated head tilt despite apparent healing from the ear infection several months after the procedure. One cat was euthanased at the request of the owners because of difficulties in controlling the *Pseudomonas* species infection. A second cat died at home a few hours after anaesthesia without any clinical signs nor determined cause. The five remaining cats were successfully treated with a ventral bulla osteotomy.

Discussion

The main clinical signs of suppurative OM with an intact tympanum were neurological: head tilt and HS. Pain was

Table 1 Signalment and clinical characteristics of all 26 cats

Cat	Breed	Age	Main complaint	Ear examination	Left tympanic membrane	Right tympanic membrane	Bacterial culture (R or L)	Follow-up
1	Maine Coon	6 years	Head tilt, ataxia	–	Normal	Normal	Negative	Healing, no relapse after 2 months
2	DSH	7 years	External otitis	Proximal plug	Normal	Bulging, opaque	Negative	Healing, relapse after 4 months for right ear, ventral bulla osteotomy
3	DSH	13 years	Chronic external otitis	–	Bulging, opaque	Normal	<i>Pseudomonas aeruginosa</i> , <i>Staphylococcus felis</i>	Healing, relapse 2 months later, ventral bulla osteotomy
4	Persian	6 years	Otalgia	Abundant cerumen	Normal	Normal	<i>Staphylococcus felis</i>	Healing, no relapse after 2 months
5	Birman	11 years	Head tilt	–	Normal	Normal	<i>Pasteurella multocida</i>	Healing, no relapse after 4 months
6	DSH	10 years	Head tilt and anisocoria	–	Bulging, opaque	Opaque	Negative	Healing, remaining mild head tilt
7	DSH	4 months	Head tilt	–	Bulging	Normal	<i>Streptococcus canis</i>	Death a few hours after anaesthesia
8	DSH	11 years	Head tilt	Cerumen	Bulging, opaque	Normal	Negative	Healing, no relapse after 2 months
9	DSH	12 years	Chronic otitis, head tilt, HS	–	Bulging	Bulging	Negative	Healing, no relapse after 2 months
10	DSH	9 years	Chronic external otitis	–	Normal	Bulging, opaque	<i>Pasteurella multocida</i>	Right ear: healing Left ear: relapse after 2 months, ventral bulla osteotomy
11	Sphynx	6 years	Head tilt, HS	–	Opaque	Opaque	<i>Staphylococcus schleiferi</i>	Healing, no relapse after 2 months
12	DSH	8 years	HS	Proximal plug	Bulging, opaque	Bulging, opaque	<i>Serratia marcescens</i>	Healing, no relapse after 2 months
13	Sphynx	3 years	Head tilt and otalgia	–	Normal	Normal	Negative	One month later: external otitis/healing 2 after months
14	Sphynx	3 months	Head tilt, HS	–	Normal	Normal	<i>Streptococcus canis</i> , <i>Escherichia coli</i> , <i>Pseudomonas aeruginosa</i>	Healing, no relapse after 8 months
15	DSH	4 months	Head tilt	Cerumen	Normal	Normal	Negative	Healing, no relapse after 8 months

(Continued)

Table 1 (Continued)

Cat	Breed	Age	Main complaint	Ear examination	Left tympanic membrane	Right tympanic membrane	Bacterial culture (R or L)	Follow-up
16	Sphynx	1 year	Otalgia	–	Normal	Normal	Negative	Relapse after 1.5 months, ventral bulla osteotomy
17	DSH	2 years	Otalgia	–	Bulging, opaque	Bulging, opaque	Negative	Healing, no relapse after 2 months
18	Maine Coon	1 year	Head tilt, HS	Cerumen	Normal	Normal	Negative	Healing, no relapse after 7 months
19	DSH	10 years	Otalgia	Abundant cerumen	Normal	Normal	<i>Staphylococcus pseudointermedius</i>	Healing, no relapse after 2 months
20	Abyssinian	4 years	Otalgia	–	Normal	Bulging, opaque	Negative	Healing, no relapse after 2 months
21	DSH	1 year	Bilateral chronic external otitis, otalgia	Oedema and erythema	Normal	Normal	Negative	Healing, no relapse after 3 months
22	DSH	7 years	Head tilt, HS and otalgia	–	Opaque	Opaque	<i>Pseudomonas aeruginosa</i>	No remission, euthanasia 1 month later by another veterinarian
23	DSH	9 months	Head tilt	–	Opaque	Normal	Negative	No remission 1 month later, ventral bulla osteotomy
24	DSH	11 years	Facial paralysis and horizontal nystagmus	–	Opaque	Opaque	<i>Pasteurella multocida</i> , <i>Staphylococcus felis</i>	Healing, no relapse after 2 months
25	Birman	12 years	Otalgia	–	Normal	Bulging, opaque	Negative	Healing, no relapse after 2 months
26	Maine Coon	4 years	HS	–	Normal	Bulging, opaque	<i>Escherichia coli</i>	Healing, no relapse after 2 months

DSH = domestic short hair cat; HS = Horner's syndrome; L = left; R = right

reported in one-quarter of these cats and was the second chief complaint. This observation is comparable with those reported in other forms of OM in cats (non-intact tympanic membrane, ear polyps).^{11,13}

Compared with studies of OM in cats, otitis externa is much less frequent (10% vs 47%).¹⁴ This is probably due to the inclusion of cats with an intact tympanum. Most cases of suppurative otitis externa in cats that are associated with suppurative OM have a tympanic rupture or ear mass and rarely result from a 'descending' infection.¹¹

To diagnose OM in cats, CT or MRI are considered the gold standard,^{9,15} however, it is necessary to confirm the

inflammatory and infectious nature of the liquid using a myringotomy and cytological examination.

The high magnification offered using otoendoscopy can help identify the signs of OM: an opaque or bulging tympanic membrane; and fluid and air bubbles seen behind the intact tympanic membrane.^{7,8} However, the sensitivity of otoendoscopy in this study was mild (57%); therefore, a lack of tympanic membrane alterations cannot exclude a diagnosis of OM.

It was not possible to obtain a positive bacterial culture despite the suppurative nature of the exudate in 25/40 (62.5%) samples studied. These data can be compared with the results of a study of 282 ventral bulla osteotomies



Figure 7 Right head tilt of cat with otitis media/interna

Table 2 Correlation between cytology and bacterial culture

		Bacterial culture	
		+	–
Bacteria on cytology	+	8	12
	–	7	13

in which the percentage of negative bacterial cultures was observed (65.2%).¹⁶ This could partly be due to previous anti-infective treatment or sample collection, which can minimise anaerobic bacterial isolation.

Isolation of bacteria on cytology was also poorly sensitive (50%). Such low sensitivity could be due to the protection of bacteria by mucus.⁸ This can also explain discrepancies between cytology and bacterial culture results.

Lack of sensitivity of both techniques could also reflect the implication of other microorganisms such as mycoplasma.^{8,17} Molecular methods, such as next-generation sequencing (NGS), could enhance the sensitivity of bacterial identification in ear effusion.

In most studies of feline OM, the bacteria involved were quite variable (*Staphylococcus* species, *Streptococcus* species, *Pasteurella* species, *Pseudomonas* species and *E coli*).^{1,14,16}

Malassezia species yeasts were not isolated on cytology. This could be due to the selection of OM without tympanic rupture limiting middle ear infections by *Malassezia* species from the external ear canal. This is not surprising,

as these yeasts require a lipid substrate that is not present in the middle ear.¹⁸ It is only during tympanic rupture that colonisation of the middle ear by *Malassezia* species can be observed.

Our study confirms previous observations on the efficacy of treatment based on systemic antibiotics.^{1,14}

This therapeutic approach, associating myringotomy, systemic antibiotics and corticosteroids, is much easier, less invasive and more comfortable than multiple ear flushing with antibiotics or ventral bulla osteotomy.^{7–12,16} It limits the risk of ototoxicity from solutions being dropped into the tympanic cavity and discomfort due to liquid present in the bulla.¹⁹ It also limits the risk of acquired drug resistance from the frequent use of antibiotics.

Myringotomy with a large catheter (2 mm diameter) was well tolerated and tympanic healing was fast (less than 4 weeks) in all cases. Because the recheck was carried out at week 4, it was impossible to assess the true speed of healing of the tympanic membrane.

The role of a myringotomy (indispensable for diagnosis) in the healing of OM is difficult to evaluate, but it at least allows a reduction in pressure within the middle ear. This can contribute to rapid improvement in neurological signs and the comfort of cats. It also provides the drainage of fluids for several days. This is why, despite the lack of direct access to the medial compartment, a myringotomy should always be recommended when neurological signs are present.

The use of systemic steroids is debatable as well as the dose and duration. Further studies are needed in cats with OM, with and without neurological signs. In human medicine, guidelines for acute OM treatment do not mention the use of steroids^{20–22} and their addition is not beneficial.²³ Treatment is limited to short-term (11–14 days) empirical systemic antibiotics.^{20,24}

However, the therapeutic approach varies significantly between cats and humans. In the case of humans, the observation of tympanic lesions during otoscopic examination is the main diagnostic element. Thus, cross-sectional imaging and myringotomy are seldom employed in these cases, unlike in cats. In cats, by performing a myringotomy, we can both promptly alleviate pain and prescribe targeted antibiotic therapy.

Conclusions

A single myringotomy combined with medical treatment successfully treats the majority of cases of closed, suppurative OM in cats. Further studies are necessary to assess the need for systemic antibiotic therapy or the duration of corticosteroid treatment.

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Ethical approval The work described in this manuscript involved the use of non-experimental (owned or unowned) animals. Established internationally recognised high standards ('best practice') of veterinary clinical care for the individual patient were always followed and/or this work involved the use of cadavers. Ethical approval from a committee was therefore not specifically required for publication in *JFMS*. Although not required, where ethical approval was still obtained, it is stated in the manuscript.

Informed consent Informed consent (verbal or written) was obtained from the owner or legal custodian of all animal(s) described in this work (experimental or non-experimental animals, including cadavers, tissues and samples) for all procedure(s) undertaken (prospective or retrospective studies). No animals or people are identifiable within this publication, and therefore additional informed consent for publication was not required.

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