OVERVIEW OF MICROBIAL CAUSES OF CANINE OTITIS EXTERNA, SUSCEPTIBILITY AND POSSIBLE TRENDS

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Introduction

Otitis externa is the most common ear disease of dogs, being up to 20% of the dog population affected by this disease. It has a multifactorial aetiology, but it is predominantly a microbial infection. Clinical signs, such as exudates and frequently erythema, oedema, offensive odour and pruritus are seen. Microorganisms belonging to the normal microbial flora of the auricular area can become pathogenic when environmental and/or primary conditions determine faster expression of their virulence factors.1

Initial treatment is usually based on what has worked best for the attending veterinarian thus far (empirical knowledge), sometimes supported by cytological examination results and clinical experience. The condition is frequently recurrent in many cases, meaning that bacteria are repeatedly exposed to a variety of antimicrobial agents. Veterinarians often express the development of bacterial resistance as a serious and significant concern when selecting an appropriate antibiotic for first-line therapy.

Malassezia genus are commonly isolated in auricular canal of dogs and cats, having otitis externa or in cases of dermatitis disorders. The yeasts of the Malassezia genus are opportunistic microorganisms and can cause both human2,3 and animal infections4. Particularly Malassezia pachydermatis (M. pachydermatis) has been reported as the predominant causative agent of canine otitis externa5.

Furthermore, among bacterial agents, it is known that Staphylococcus, Pseudomonas, Escherichia, and Proteus species are considered important pathogens causing otitis externa in dogs6. Among Gram-positive bacteria, Staphylococcus pseudointermedius, (S. pseudintermedius) a coagulase-positive staphylococcal species, is frequently associated with pyoderma, otitis externa, urinary tract infections, and opportunistically infected sites in dogs7. Among Gram-negative bacteria, Pseudomonas aeruginosa (P. aeruginosa) plays a major role in otitis externa also because of the increasing number of multiresistant strains8.

In a local retrospective study, results from bacterial culture and susceptibility testing from dogs with otitis externa performed by IDEXX Laboratories South Africa were collated for the period January 2013 to April 2014. Samples from dogs with otitis externa (861 cases) received by IDEXX Laboratories over a sixteen (16) month period, yielded 1763 isolates (dogs). Staphylococcus pseudintermedius isolates predominated in dogs (359) followed by Pseudomonas aeruginosa (352), Enterococcus (303), Streptococcus canis (229; S. canis) and Escherichia coli (127; E. coli)9.

Diagnostic evaluation11

Admittedly, not every case of otitis externa requires an extensive diagnostic work-up and primary factors (ear mites or foreign bodies) may be easily diagnosed and dealt with. Recurrent and chronic cases should receive a detailed evaluation as elaborated below.

History: a detailed history should be taken, since otitis externa is often a manifestation of a generalised skin condition.

Dermatological examination: a complete dermatological examination should precede specific examinations. Specific areas concentrated on include the anal sacs, interdigital skin and mucocutaneous junctions. If lesions are seen, they should be biopsied and submitted for culture and histopathology. If an auto-immune condition is suspected, fluorescent antibody and/or immuno-peroxidase examinations should be performed. The pinna and ear canal should be examined for proliferations, thickening and pain.

Neurological examination: a neurological examination concentrating on facial palsy (drooping lip, drooling, diminished palpebral reflex and keratitis), Horner’s syndrome (ptosis, miosis, enophthalmus, protrusion of the 3rd eyelid), and inner ear involvement (nystagmus, head tilt, ataxia) are all indicative of vestibular disease. These cases are far more demanding to treat and often represent an irreversible change for which the owner must be counselled.

Radiological examination: at this point the animal is anaesthetized and radiographs are made. We find that the most useful view is an open-mouthed view (R300V-CdDO) with the endotracheal tube removed. The animal is placed in dorsal recumbency with the mouth pulled open and the hard palate and mandible angled at 30 degrees to the X-ray beam. This view projects the bulla with minimal overlying bony structures. On this view, narrowing of the ear canal air column as well as calcification of the canals signifies chronic otitis externa. Normal bullae are symmetrical, thin-walled opacities at the base of the skull. Indications of chronic otitis
media include opacification of the bulla lumen, asymmetrical thickening or thinning of the bulla wall, and sclerosis of the petrous temporal bone. This is not a sensitive modality in that false negatives are frequent recorded (reported up to 25%).

Cytological examination: exudate is swabbed from the horizontal part of each ear canal with a clean cotton bud. If ear mites are suspected, mineral oil is added, and the slide examined under 10x magnification. Additional swabs are rolled onto glass slides and stained with Diff Quick. Under 40X or 100X magnification the following aspects are assessed: Number and morphology of bacteria, presence of yeasts, type of cellular infiltration, presence of bacterial phagocytosis, and epithelial cells. Cocci usually represent gram +ve bacteria, specifically Staphylococcus sp. These are often seen as diplococci (two united cocci), whereas rods generally represent gram -ve organisms (including Pseudomonas sp., Proteus sp., E. coli). Cytological examination is particularly useful in assessing response to treatment e.g. absence of bacteria in the presence of an inflammatory response indicates a systemic disease such as a hypersensitivity condition. At least 10 fields should be examined. Several yeast cells per field exceeding 5 yeast/field represents excessive colonization by the organism and is generally considered a positive (infection). Several bacteria exceeding 25 per microscopy field (40x) is considered positive (infection) as previously described by Ginel et al. 10.

Otoscopic examination: this is usually accompanied by ear cleaning. Ringer lactate is considered the ideal cleaning solution and is applied through an otoscope with a syringe and soft open-ended feeding tube or heavy gauge intravenous canula. Repeated flush-aspirate cycles will harmlessly and effectively remove most debris. Ear-loop curette and fine alligator forceps may be used to aid removal of larger particles. If the tympanic membrane if perforated, the middle ear is also flushed and aspirated. Once cleaned, the ear canal, ear drum and middle ear may be assessed. A clean canula should be employed for each canal so as not to cross-infect.

The ear canal is examined for parasites or foreign bodies, type of lesion (ulcerative or proliferative), growths, presence of hair, and degree of narrowing. The tympanic membrane consists of a central pars tensa and a muscular, dorsal pars flaccida. The aforementioned is semi-transparent, has a finely rifled appearance. The ear drum is concave due to the medial pull of the ossicles which can be seen through the pars tensa. A fine network of capillaries radiate from the attachment of the malleus to the membrane. The ear drum is examined for its completeness, thickening (myringitis), opacification, outward bulging or inner opacification indicating space occupation within the middle ear. A ruptured membrane in the presence of an otitis externa implies an otitis media. If the ear drum is accidentally punctured, it will heal completely within 3 weeks if there is no infection present. In rare cases where there is a fluid or soft tissue accumulation within the middle ear with an intact membrane and healthy ear canal, the contents may be aspirated through the drum using a fine spinal needle (myringotomy).

If the tympanic membrane is ruptured, topical medications should be chosen judiciously as a few preparations are reported to be ototoxic.

Culture and sensitivity: Ear canal cultures are not routinely performed because of the presence of normal commensals, the overgrowth of certain organisms e.g. Pseudomonas, and in vitro sensitivity testing may not approximate the effect of high levels of antimicrobial agent within the ear canal. Indications for culture and antiogram are reportedly the presence of otitis media (bacteria such as Mycoplasma, Pasteurella and Acinetobacter would be more likely to occur on mucous membranes than in the external ear canal11), and apparent resistance to topical antibiotics especially if Gram negative organisms are seen on cytology.

Biopsy: biopsies of the pinnal skin and accessible parts of the vertical canal may be useful if diagnosis is not apparent after the above-mentioned techniques have been performed. This technique may be especially useful in chronic cases of otitis externa where the primary cause is masked by chronic secondary bacterial inflammation. The biopsies are taken with a 4 mm punch.

Antimicrobial cultures

Reviewing literature from 1998 – 2018 the most commonly isolated microorganisms isolated can vary from year to year and from country to country which may be indicative of changes in the microbial challenges faced by our pets and/or changes to the susceptibility of these microbes to the antibiotics available.

In a European monitoring program of the pre-treatment susceptibility of clinical isolates of bacteria from diseased dogs and cats, active between the years 2002 and 2009, the top three bacterial isolates in ears were P. aeruginosa, S. pseudintermedius and Staphylococcus aureus (S. aureus) 11.

Results of bacterial culture and susceptibility testing performed by IDEXX Laboratories Pty Ltd (Australia) on swabs taken from the ears of dogs were collated for the period May 2008 to April 2009, the five most frequently isolated microorganisms from cultures of 3541 canine ear swabs performed from May 2008 to April 2009 were P. aeruginosa (35.5%), S. pseudintermedius (24.3%), Proteus sp. (6.8%), beta-haemolytic streptococci (6.2%) and E. coli (4.2%)14.

The Czech Republic’s University of Pardubice, most frequently isolated microorganisms in association with otitis externa were S. pseudintermedius (58.8%), S. canis (29.9%), Proteus spp. (14.4%), E. coli (10.3%) and P. aeruginosa (7.2%)15.

Similarly, the University of Tehran in Iran completed a microbial identification and antibiotic susceptibility study in dogs with otitis externa. Of 92 isolated bacteria, 77 isolates (83.70%) were Gram-positive cocci, and 15 isolates (16.30%) were Gram-negative rods.
The entire isolated Gram-positive cocci were belonged to the *Staphylococcus* genus (*Staphylococcus pseudintermedius*; 73.91%) and isolated Gram-negative rods were belonged to four different genera including *Pseudomonas* (*P. aeruginosa*; 10.87%), *Proteus* (*Proteus mirabilis*; 3.26%), *Escherichia* (*E. coli*; 1.09%), and *Pasteurella* (*Pasteurella canis*; 1.09%)\(^1\).

Finally, in South Africa, results from bacterial culture and susceptibility testing from dogs with otitis externa performed by IDEXX Laboratories South Africa were collated for the period January 2013 to April 2014. Samples from dogs with otitis externa (861 cases) received by IDEXX Laboratories over a sixteen (16) month period, yielded 1763 isolates (dogs). *S. pseudintermedius* isolates predominated in dogs (41.69%) followed by *P. aeruginosa* (40.88%), *Enterococcus* (35.19%), *S. canis* (26.59%) and *E. coli* (14.75%)\(^2\).

Chronologically, *S. pseudintermedius* and *P. aeruginosa* have maintained their higher incidence rates in the top two most commonly isolated bacteria across 4 out of the 5 studies summarised above. *Proteus mirabilis* incidence seems to have decreased over time and in the latest two studies (2014) of the ones discussed above, this bacterium does not feature in the top 3 of bacteria isolated as it did in previous years. The incidence of *S. canis* seems to be unpredictable over the years and varying greatly from country to country. The incidence of *E. coli* seems to have increased simply because it now features in the top 5 lists of all the studies where these lists name the 5 most frequently isolated canine otitis externa pathogens. The 3 odd bacteria isolated across all the studies and the only ones that do not seem be found repeatedly in these studies are *S. aureus*, *Enterococcus* and *Pasteurella canis*. Whether these become more commonly isolated pathogens in canine otitis externa will be determined later in subsequent studies monitoring the incidence of these bacteria.

*Malassezia pachydermatis* was the second most commonly isolated (30.9%) microbe in the Czech Republic study\(^1\) and third most commonly isolated (12.06%) in an Italian study\(^1\). In South Africa, results from a bacterial culture and susceptibility testing review for samples isolated from dogs with otitis externa between 2002 – 2007, performed by Dr Marijke Henton of IDEXX, demonstrated that *Malassezia* was isolated in 10.5% of canine samples submitted and was the 5th most commonly isolated pathogen in cases of otitis externa\(^1\).

**Antimicrobial susceptibility testing**

The antimicrobial susceptibility patterns of isolated bacterial strains are usually determined by disk diffusion test using various antibiotic disks are measured after incubation for 24 hours at 37°C and evaluated according to the Clinical and Laboratory Standards Institute\(^1\).

Drug classes usually included over the past few years in antibiotic susceptibility testing use commercial disks containing various combinations of the drugs in the table below depending on the laboratory used:

<table>
<thead>
<tr>
<th>Antibiotic class</th>
<th>Representatives of the class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penicillins</td>
<td>Benzylpenicillin, mezlocillin, ampicillin, amoxicillin-clavulanic acid combination, and oxacillin.</td>
</tr>
<tr>
<td>Cephalosporins (1st gen)</td>
<td>Cefadroxil, cephalothin</td>
</tr>
<tr>
<td>Cephalosporins (2nd gen)</td>
<td>Cefoxitin</td>
</tr>
<tr>
<td>Cephalosporins (3rd gen)</td>
<td>Ceftriaxone</td>
</tr>
<tr>
<td>Fluoroquinolones</td>
<td>Enrofloxacin and norfloxacin</td>
</tr>
<tr>
<td>Aminoglycosides</td>
<td>Gentamicin, amikacin, kanamycin, neomycin and streptomycin</td>
</tr>
<tr>
<td>Glycopeptides</td>
<td>Vancomycin</td>
</tr>
<tr>
<td>Macrolides</td>
<td>Erythromycin</td>
</tr>
<tr>
<td>Polypeptides</td>
<td>Bacitracin, colistin sulfate, polymyxin B</td>
</tr>
<tr>
<td>Tetracyclines</td>
<td>Doxycycline and tetracycline</td>
</tr>
<tr>
<td>Lincosamides</td>
<td>Lincomycin, clindamycin</td>
</tr>
<tr>
<td>Chloramphenicol</td>
<td>Chloramphenicol</td>
</tr>
<tr>
<td>Sulphonamides</td>
<td>Sulfamethoxazole/trimethoprim</td>
</tr>
<tr>
<td>Antifungals</td>
<td>Amphotericin B, fluconazole, clotrimazole, itraconazole, miconazole</td>
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Table 1: Drugs representing the various antibiotic classes used in microbial susceptibility testing for submitted ear samples to laboratories\(^1,12\).

The strains grown are subsequently exposed to these drugs and categorized as sensitive or resistant to the drug, while intermediate susceptibility is regarded as resistant\(^1\). An isolate is defined multiresistant if it showed resistance to 3 or more different classes of antimicrobials\(^13\).

Constant and regular updates illustrating an increase in antibiotic resistances providing an insight into the current knowledge of the therapeutic procedures followed on canine otitis externa in veterinary medicine. It also emphasizes the importance of considering the results of the microbiological and sensitivity tests to decide on an appropriate antibiotic therapy. There is a school of thought which perceives the results of antibiograms as irrelevant based on the rationale that the concentration of active antibiotic ingredients in the ear canal post-treatment is higher than that to which the bacteria are exposed in an antibiotic susceptibility test,
which means that a microbe that seems to demonstrate resistance to a drug in the antibiogram may very well be sensitive to the treatment in reality. Such disparity in results raises questions over the usefulness of such antibiograms, along with questions about the added effort, cost and ethical considerations that go along with it.

In South Africa, results from a bacterial culture and susceptibility testing review for samples isolated from dogs with otitis externa between 2002 – 2007, performed by Dr Marijke Henton of IDEXX, yielded the semi quantitative susceptibility results summarised in Table 2 below. The author has added the most recent (2014) susceptibility results available for comparison purposes. Note that by 2014, *Enterobacter* which was part of the top five bacteria isolated in 2007, was subsequently replaced by *E. coli*. Significant variations have been highlighted in grey.  

**Table 2: Antibiotic susceptibility results for the five most common bacteria isolated from canine ear samples for the period January 2002 to April 2014**. The highlighted antibiotics are the active ingredients for which South Africa has registered products available on the market at the time of publication. NA = not assayed.

### Staphylococcus spp. resistance

During the past few years, there has been confusion about the identification of this species. Using a multilocus sequencing approach, independent research groups have demonstrated that isolates phenotypically identified as *Staphylococcus intermedius* consist of three distinct species, including *S. intermedius*, *S. pseudintermedius*, and *S. delphini*, which together represent the *S. intermedius* group (SIG). Importantly, it was discovered that *S. pseudintermedius*, but not *S. intermedius*, is the common aetiological agent of canine pyoderma and that *S. delphini*, isolated from a variety of different animals, may be more clinically important than was previously thought. Results of antibiotic resistance testing are significant, because of the rising incidence of isolation of methicillin-resistant SIG (MRSIG). In the past, these strains were reported to be susceptible to β-lactam antibiotics, but methicillin-resistant SIG, particularly *S. pseudintermedius* (MRSP) strains are being reported with increasing frequency. Methicillin-resistant *S. pseudintermedius* have been isolated from dogs, cats and humans. Strains isolated from clinical samples, especially with history of previous antibiotic treatment are very often multiresistant. It is well documented for many organisms, including SIG strains, that the clinical use of antimicrobial drugs selects for resistant bacteria. In 2006, a sudden rise in isolation of methicillin-resistant SIG (MRSIG) from clinical specimens of animal origin was noted.

Results of bacterial culture and susceptibility testing performed by IDEXX Laboratories Pty Ltd (Australia) on swabs taken from the ears of dogs were collated for the period May 2008 to April 2009, the resistance of *S. pseudintermedius* to enrofloxacin (Ciprofloxacin 2.5 µg was used as the surrogate for enrofloxacin in 2008, with moxifloxacin 2.5 µg used from 2009) was reported to be 2%, gentamicin 1%, polymyxin B 100%, neomycin 4% and Framycetin (Neomycin 30 µg) was used as the surrogate for framycetin for the entire test period.) was 4%. 

In a Brazilian study (2009) bacterial culture and susceptibility testing yielded the following results for *S. pseudintermedius*:

### Table 3: Numbers and percentages in each column under ‘antimicrobial resistance’ represent proportions of isolates that were resistant to each antibiotic. Percentages indicate frequencies of resistant isolates to each antimicrobial agent in the period of the study.

<table>
<thead>
<tr>
<th>Antimicrobial resistance (%)</th>
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<tr>
<td>AMC</td>
</tr>
<tr>
<td>S. pseudintermedius</td>
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*Note: AMC, amoxicillin + clavulanic acid; AMO, amoxicillin; OXA, oxidizing; CFD, cefadroxil; CFE, cefalexin; CIP, ciprofloxacin; ENO, enrofloxacin; CLO, chloramphenicol; AMI, amikacin; GEN, gentamicin; NEO, neomycin; BAC, bacitracin; ERI, erythromycin; MUP, mupirocin; NIT, nitrofurantoin.*
The Czech Republic’s University of Pardubice completed a study where *S. intermedius* showed resistance to Penicillin G (66%), ampicillin (7%), erythromycin (44%), chloramphenicol (34%), clindamycin (39) and tetracycline (35%)\textsuperscript{15}.

In the Iranian study discussed previously, all *Staphylococcus spp.* strains were susceptible to amikacin (0%), enrofloxacin (0%), and rifampin (0%). They had also low resistance to gentamicin (2.6%), cephalothin (5.5%), and ceftriaxone (6.49%). The most active resistance occurred to penicillin (61.04%), and ampicillin (53.25%), and it was considerable against trimethoprim-sulfamethoxazol (37.66%) and oxytetracycline (33.77%)\textsuperscript{16}.

A study in Italy yielded even more wide-spread significant resistance levels in *S. pseudintermedius*. Penicillin G 57.7%, oxacillin 8.9%, Amoxicillin-clavulanic acid 35.5%, ceftriaxone 11.1%, norfloxacin 11.1%, enrofloxacin 15.5%, gentamicin 11.1%, kanamycin 62.2%, neomycin 31.1%, streptomycin 46.6%, vancomycin 11.1%, erythromycin 31.1%, bacitracin 68.8%, doxycycline 15.5%, tetracycline 35.5%, lincomycin 20% and sulfamethoxazole/trimethoprim 46.6%\textsuperscript{3}.

**Pseudomonas spp. resistance**

*P. aeruginosa* is a gram-negative aerobic bacterium that was present in 26% to 35% of cases of canine bacterial otitis in a study completed in Illinois/Florida, USA\textsuperscript{20}, for which bacterial culture was performed, classically when rod bacteria were seen on cytology. In one study, *P. aeruginosa* was the sole bacterial pathogen in 33% of cases in which it was isolated\textsuperscript{21}. Treatment of *P. aeruginosa* otitis is challenging, because some strains of the bacterium have developed multidrug resistance. Moderate to high levels of resistance to some commonly used antibiotics have been reported for *P. aeruginosa* isolates recovered from cases of chronic canine otitis\textsuperscript{20}.

Results of bacterial culture and susceptibility testing performed by IDEXX Laboratories Pty Ltd (Australia) on swabs taken from the ears of dogs were collated for the period May 2008 to April 2009, the resistance of *Pseudomonas* to enrofloxacin (Ciprofloxacin 2.5 \(\mu\)g was used as the surrogate for enrofloxacin in 2008, with moxifloxacin 2.5 \(\mu\)g used from 2009) was reported to be 36%, gentamicin 5% and polymyxin B 7%\textsuperscript{14}.

The Czech Republic’s University of Pardubice completed a study where *P. aeruginosa* showed resistance to ampicillin (7%), amoxicillin-clavulanic acid (7%), enrofloxacin (5%), ofloxacin (3%), streptomycin (7%), sulfamethoxazole/trimethoprim (7%), chloramphenicol (7%) and rifampicin (7%)\textsuperscript{15}.

In the Iranian study discussed previously, all *Pseudomonas aeruginosa* strains were susceptible to amikacin (0%) and enrofloxacin (0%), and it was low against ceftriaxone (10%) and gentamicin (10%). Ampicillin, amoxicillin-clavulanic acid, cephalothin, erythromycin, rifampin, penicillin G and lincomycin-spectinomycin were the least effective antimicrobial agents against *Pseudomonas aeruginosa*\textsuperscript{16}.

A study in Italy yielded even more wide-spread significant resistance levels in *P. aeruginosa*. Ampicillin 73.9%, Amoxicillin-clavulanic acid 78.3%, ceftriaxone 39.1%, enrofloxacin 43.5%, gentamicin 8.7%, kanamycin 87%, neomycin 65.2%, streptomycin 78.3%, vancomycin 52.2%, bacitracin 100%, doxycycline 78.3%, tetracycline 69.6%, lincomycin 69.6% and sulfamethoxazole/trimethoprim 17.4%\textsuperscript{4}.

**Malassezia susceptibility tests**

*M. pachydermatis*, normally present on the skin and in the ear canal of dogs and cats, frequently causes dermatitis and otitis in mammals. However, the pathogenic role of *Malassezia* in the occurrence of lesions seems to be related to the host immune system as well as to yeast virulence factors. Conditions, such as atopic or seborrhoeic dermatitis, parasitic infestation, diabetes mellitus in dogs, feline immunodeficiency virus, and feline leukaemia virus infections, and long-term antibiotic use associated with glucocorticoid treatment may predispose to *Malassezia* overgrowth, usually leading to development of lesions. Additionally, lesions might appear because of hypersensitivity reaction to yeast allergens or might be prevented by active stimulation of the reticuloendothelial system\textsuperscript{23}.

In South Africa, results from a microbial culture and susceptibility testing review for samples isolated from dogs with otitis externa between 2002 – 2007, performed by Dr Marijke Henton of IDEXX, *M. pachydermatis* was the 5th highest number of positive isolates, and accounted for 10.5% of the positive samples in dogs\textsuperscript{17}. In this study the Malassezia isolated was 95% sensitive to the 3 antifungals available on the market at the time i.e. nystatin, miconazole and clotrimazol\textsuperscript{17}.

The Czech Republic’s University of Pardubice completed a study where *M. pachydermatis* was the most commonly isolated yeast. It was recovered from 30.9% of otitic ears and from 10.7% of clinically normal ears. In the latter study, *M. pachydermatis* was susceptible to all antymycotics tested except for fluconazole (4.4% of resistant strains), and these results agree with the findings of Eichenberg et al\textsuperscript{24}. On the other hand, much lower susceptibility to ketoconazole, fluconazole and itraconazole was reported by Nascente et al\textsuperscript{25} who found only 57.1%, 64.3% and 28.6% of *M. pachydermatis* isolates susceptible\textsuperscript{15}. Although the in vitro susceptibility testing is not yet standardized for *Malassezia spp.*, the Clinical and Laboratory Standards Institute (CLSI) broth
microdilution protocol was adapted by modifying media, time of incubation, and inocula, showing that itraconazole, ketoconazole, and posaconazole are the most effective drugs. 

A study in Italy detected yeasts in a total of 53 swabs samples out of 193, with *M. pachydermatis* presenting the highest prevalence (67.74%) followed by *Candida parapsilosis* (12.90%). These diseased dogs after local therapy with miconazole and prednisolone acetate, for at least 2 weeks, showed a remission of symptoms

Conclusions and Possible Trends

Otitis externa is the most common ear disease of dogs, being up to 20% of the dog population affected by this disease. It has a multifactorial aetiology, requiring that our diagnostic evaluation needs to be systematic as well as thoroughly explained to the pet owners so that their short-term and long-term expectations can be managed appropriately. Veterinarians often express the development of bacterial resistance as a serious and significant concern when selecting an appropriate antibiotic for first-line therapy. Otoscopic and cytological examination are particularly useful in selecting appropriate medications (especially in the absence of culture and antimicrobial susceptibility testing) and in assessing response to treatment e.g. absence of bacteria in the presence of an inflammatory response indicates a systemic disease such as a hypersensitivity condition. Furthermore, antibiograms help in the continuous monitoring of microbial resistance development.

In South Africa, results from bacterial culture and susceptibility testing from dogs with otitis externa in 2014 revealed that *S. pseudintermedius* isolates predominated in dogs (359) followed by *P. aeruginosa* (352), *Enterococcus* (303), *S. canis* (229) and *E. coli* (127). Some significant changes have occurred between 2007 and 2014 in South Africa i.e. *Enterobacter* which was part of the top five bacteria isolated in 2007, was subsequently replaced by *E. coli*. The three commercial otitis externa remedies in the South African market provide gentamicin, polymyxin B and neomycin. The efficacy of gentamicin against *S. pseudintermedius*, *P. aeruginosa*, *Enterobacter* and *E. coli* remains good, while streptococcal and enterococcal infections may be more challenging. Polymyxin B efficacy against *P. aeruginosa*, *Enterobacter* and *E. coli* remains good, while infections with *S. pseudintermedius*, *S. canis* and *Enterococcus* may be more problematic. Finally, neomycin efficacy against *S. pseudintermedius* and *Enterobacter* remain good, while infections with *P. aeruginosa*, *S. canis*, *Enterococcus* and *E. coli* may be more problematic. In such resistant cases, compounded and/or newer otitis externa products may be more useful.

In South Africa, results from a microbial culture and susceptibility testing review for samples isolated from dogs with otitis externa between 2002 – 2007, performed by Dr Marijke Henton of IDEXX, *M. pachydermatis* was the 5th highest number of positive isolates, and accounted for 10.5% of the positive samples in dogs. In this study the *Malassezia* isolated was 95% sensitive to the 3 antifungals available on the market at the time i.e. nystatin, miconazole and clotrimazole. A follow up review of the susceptibility of *Malassezia* to our locally available antifungals would be valuable.

Although overseas antimicrobial susceptibility testing may vary from our results in South Africa, it does highlight the need for continuous monitoring and awareness of the development of multidrug resistant microbes.

References


17. Henton MM. An Earful of bugs. IDEXX Laboratories sponsored study. 2007