



THE PATHOGENESIS OF CANINE OTITIS EXTERNA – UNDERSTANDING THE SIGNIFICANCE OF ALLERGY

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BACKGROUND

Canine otitis externa is an extremely common condition within first-opinion practice, with two recent studies reporting the incidence at 7.3% and 10.2%^{1,2} which was the highest prevalence of any disease recorded by UK veterinarians. In terms of perceived disease severity, it has been ranked as second only to osteoarthritis.³ Despite these statistics, it remains a frustrating disease for the veterinarian, owner and pet alike. For these reasons, it is of the utmost importance that a systematic approach is adopted that embraces the complicated and multifactorial nature of its pathogenesis.

THE AETIOLOGY OF CANINE OTITIS EXTERNA

Specialist clinicians have for some years been united in their adoption of the PSPP-system, which categorises the factors contributing to the pathogenesis of otitis as primary, secondary, predisposing and perpetuating. These factors will be considered here in a potentially more logical sequence, commencing with predisposing causes (Table 1).

Table 1. The Causes of Otitis Externa

	Definition	Examples
Predisposing	Makes the condition more likely to occur	Conformation that impedes air circulation within the ear canal Obstructive ear disease such as tumours or polyps High environmental temperatures or humidity Excessive bathing, swimming
Primary	Can induce otitis in a normal ear	Atopic dermatitis Food allergy Foreign body Parasites (Otodectes mites, Demodex mites)
Secondary	Will add to the symptomatology once it has been initiated	Bacterial infections Yeast infections
Perpetuating	Chronic pathological changes that are difficult to resolve	Impedance of the physiological cleaning mechanisms Pathological changes of the lining of the ear canal; hypertrophy followed by atrophy of the glandular structures Eventual calcification of the ear canal

PREDISPOSING CAUSES

These are defined as making the condition more likely to occur. Thus, on their own, they contribute to, but cannot initiate the condition. Most important are breed and conformation, and a recent paper has analysed these in detail.²

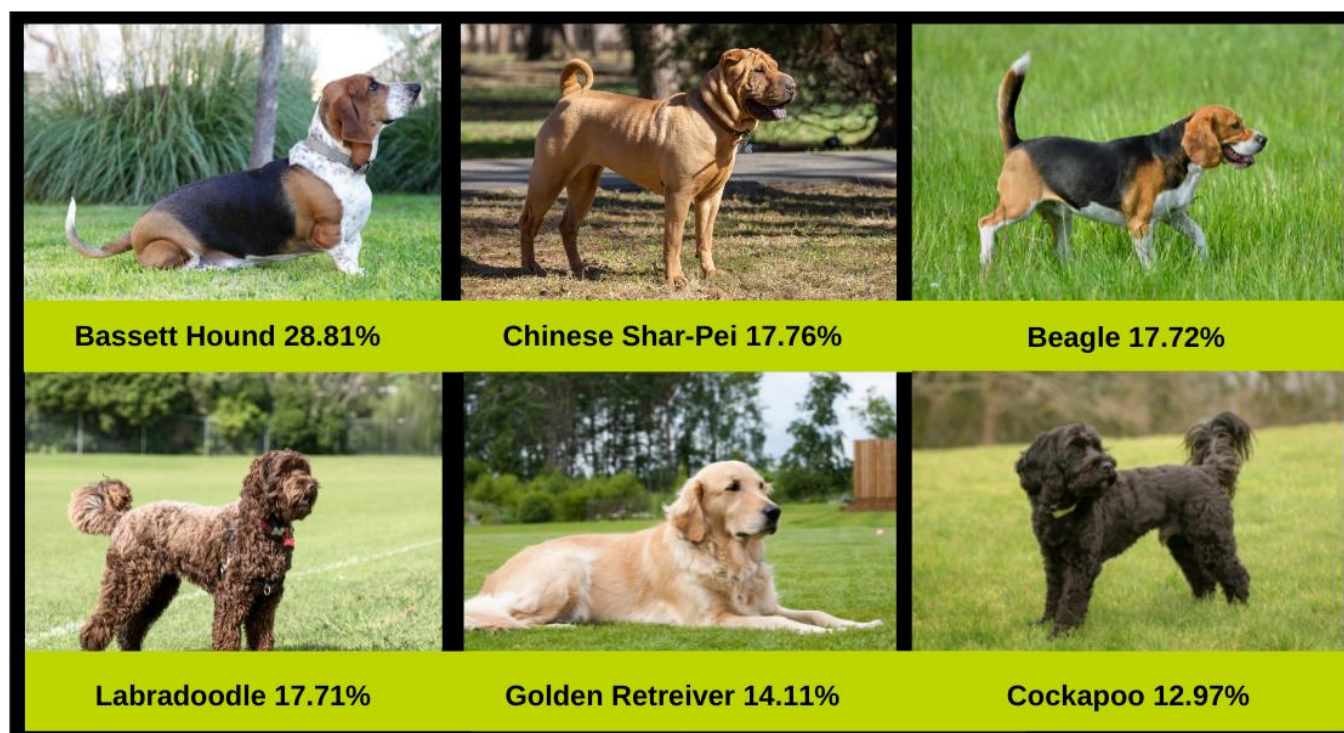


Figure 1. The breeds found to have the highest mean prevalence of otitis in a one-year period²

All spaniel and poodle type dogs were also shown to be predisposed. Overall, breeds with pendulous and V-shaped drop ear carriage had significantly higher odds ratios when compared to those with erect and semi-erect ears (Figure 2). The common factor amongst these breeds is limited air circulation within the ear, resulting in increased local humidity. The exception to this rule is the shar-pei with its erect ears, but this breed has a narrow and folded canal which similarly impedes air circulation. Access of water to the ears from excessive bathing or swimming has a similar effect.

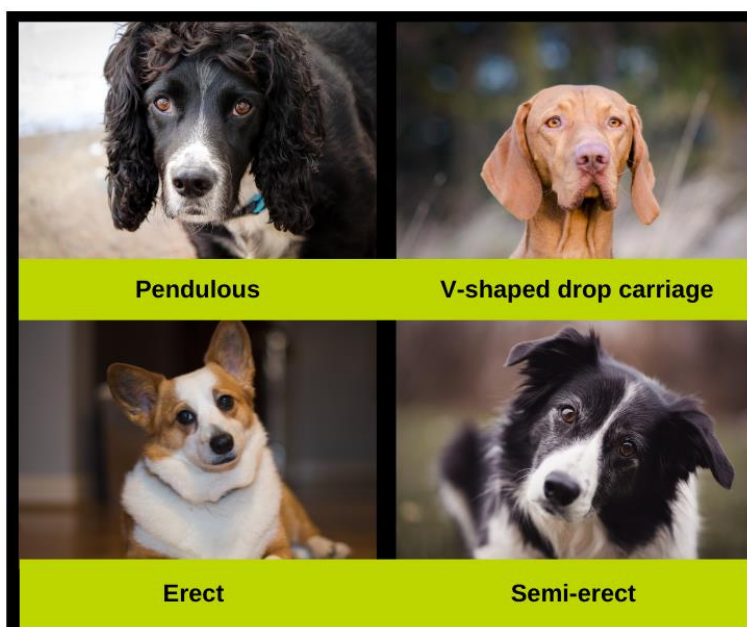


Figure 2. Examples of different ear types in dogs

PRIMARY CAUSES

These are defined as factors which are able to induce otitis in a normal ear. They include:

Parasitic diseases: Most important of these is *Otodectes cynotis*, which has been reported as being responsible for up to 50% of cases in cats, but it is less common in dogs. Demodicosis has occasionally been observed to cause an otitis, even in the absence of generalised disease.



Figure 3. *Otodectes cynotis* – ear mite

Allergic diseases: Allergic diseases are unquestionably the most common primary cause of otitis; of these, canine atopic dermatitis (CAD) is the most prevalent and important cause, but the role and significance of food allergy must not be underestimated (note: as adverse food reactions have yet to be unequivocally associated with anything other than immunological reactivity, the term food allergy has recently been proposed as an immunological definition that is now preferred to adverse food reactions).⁴ Contact allergy can also occasionally develop to constituents of otic medications; such cases are characterised by an initial improvement in the otic signs, followed by a sudden deterioration.

To demonstrate just how significant allergic disease is in otitis cases, it is worth looking further at the available prevalence data. Allergy (unspecified - CAD or food allergy) was found to be the inciting cause in 43% of first-opinion cases of otitis,⁵ with an even higher proportion (>75% of cases) attributed to CAD in a large referral-based study.⁶ Furthermore, looking at dogs already diagnosed with CAD, it was shown that around 50% exhibited otic signs and importantly, in 43% of cases, owners reported that these were the initial presenting signs – emphasising that otitis can be the only sign in CAD.^{7,8} In some instances, other typical dermatological signs develop with time, but in others otitis persists as the only manifestation of allergic disease. This has led to the use of the term “atopic otitis” to describe cases of CAD that exhibit solely otic signs. The definitive diagnosis of such cases can be problematic when one relies upon diagnostic criteria, but careful observation of the disease state as it progresses can sometimes show evidence of minor non-otic disease.

Although food allergy is less common than CAD, the proportion of cases with an associated otitis is similar, and has been reported as 55%, 65% and 80% in three separate studies.⁸⁻¹⁰ Significantly, in one of these studies, otitis was the initial presenting sign in 34% of cases.⁸ Anecdotal reports suggest that Labrador retrievers and cocker spaniels are predisposed to suffering from otic signs alone.¹¹

In terms of clinical presentation, CAD and food allergy can be impossible to distinguish from one another; however, careful assessment of the otic signs can offer some important pointers:

- In dogs with CAD, the otic inflammation typically commences on the concave surface of the pinna, and then extends into the vertical canal. Only in the later stages does the horizontal canal become involved with secondary infection (Figure 4).
- In contrast, in food allergy the inflammation typically commences in the horizontal canal and may spread to involve the vertical canal and then the lower aspects of the concave surface of the pinna in the later stages (Figure 5).



Figure 4. Chronic CAD – erythema



Figure 5. Less involvement of the pinna but more severely affected vertical canal suggestive of chronic food allergy

Food allergy also tends to affect younger dogs, with 46.5% and 48% commencing at <1yr as opposed to 38% and 16% in the case of CAD in two studies.^{7,8} Cases with later onset are again more likely to be food allergy, with 8.7% commencing at >6yrs as contrasted with 3.8% of cases suffering from CAD.⁷ Finally, food allergy patients tend to have a greater incidence of concomitant gastrointestinal signs and tend to be less corticosteroid responsive.⁷ The contrasting features are summarised in Table 2.

Table 2. Contrasting features between CAD and food allergy

	CAD	Food allergy
Age of onset <1year	38.6% ⁷ ; 16% ⁸	46.5% ⁷ ; 48% ⁸
Age of onset <3 years	78.8% ⁷ ; 78% ⁸	77.3% ⁷ ; 83% ⁸
Age of onset >6 years	3.8% ⁷	8.7% ⁷
Concomitant gastrointestinal signs	10.5% ⁷ ; 1% ⁸	26.2% ⁷ ; 31% ⁸
Corticosteroid responsive	85.2% ⁷ ; 84% ⁸	64% ⁷ ; 74% ⁸
Features of the otitis	Typically commences on the concave surface of the pinna	Typically commences in the horizontal canal
Statistically significant predisposed breeds⁸	West Highland white terrier Boxer French bulldog Bull terrier Dalmatian Hungarian vizsla Basset hound	West Highland white terrier Boxer German shepherd Pug Rhodesian ridgeback

Foreign bodies: "Foxtails" (grass awns) are a common cause of acute onset disease, especially in rural areas and severe pain is expected in the history. Although grass awns are readily visualized in the early stages, they may later become obscured by inflammatory exude.

Keratinisation abnormalities: Endocrinopathies (particularly hypothyroidism) and inherited keratinisation defects are usually generalised in nature, with the ears often involved as they are part of the integument. They will usually be evident from the general physical examination, and workup for an endocrinopathy and/or biopsies can be taken as indicated.

Autoimmune diseases: The ear may be involved in autoimmune disease, particularly in pemphigus foliaceus (Figure 6), but it is worth noting that the disease is never restricted to the ear.

Juvenile pyoderma: The ear is often involved in this condition (Figure 7), which typically affects one or more in a litter at around 8-12 weeks of age. Affected animals are febrile and systemically ill, and show marked lymphadenopathy.



Figure 6. *Pemphigus foliaceus* showing circumscribed areas of erythema and crusting not to be confused with more diffuse erythema as seen in CAD



Figure 7. Juvenile pyoderma

SECONDARY CAUSES

These are defined as agents that cannot induce disease in a normal ear, but in an abnormal ear they will proliferate and contribute to the disease, e.g., gram-positive and gram-negative bacteria and also yeasts (Figures 8 and 9).

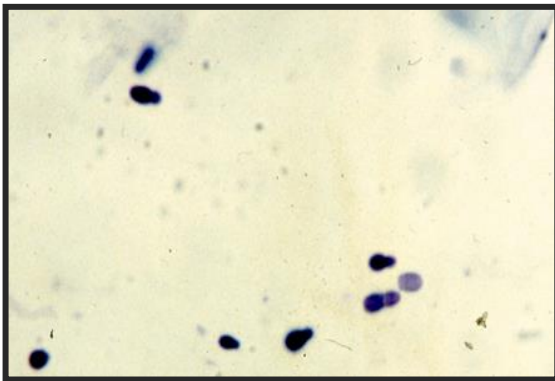


Figure 8. *Malassezia*

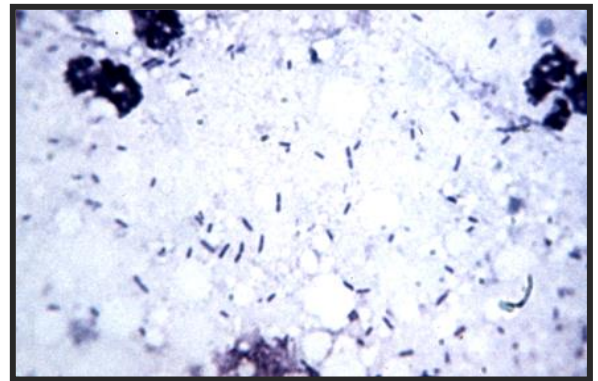


Figure 9. Rods and a few cocci

PERPETUATING CAUSES

These are changes that occur within the ear canal as a result of the disease which can, in turn, contribute to the disease progression and hinder its resolution.

Progressive pathological changes: Inflammation causes a progressive narrowing of the ear canal, secondary to the aforementioned issues regarding air circulation and local humidity in predisposed breeds. It also impedes epithelial migration, leading to a loss of the normal clearing mechanisms, as well as resulting in initial hypertrophy, followed by atrophy, of the sebaceous glands. In long-standing cases, ulceration may facilitate bacterial replication.

Verrucose proliferations may further impede air circulation (Figure 10), and chronic inflammation may ultimately cause calcification of the ear canal - a change that is irreversible. The sequence of the changes in long-standing cases is depicted in Figure 11.



Figure 10. Chronic CAD with verrucose proliferation

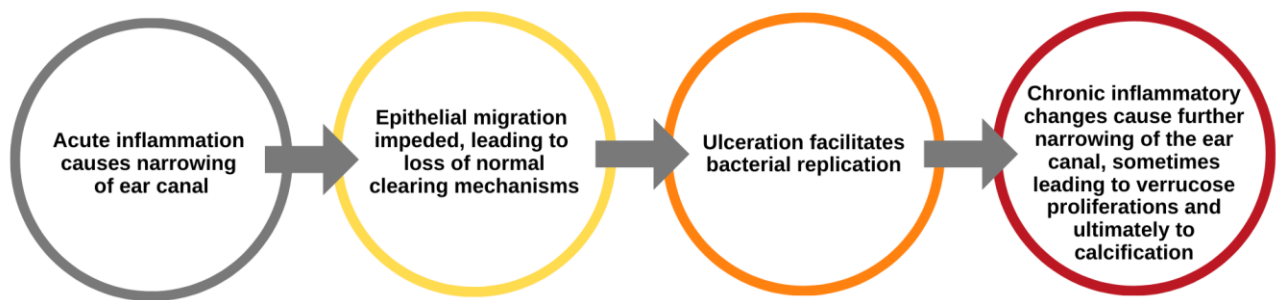


Figure 11. Progressive changes that may occur in the ear canal in chronic cases

Otitis media: Otitis media may occur in as many as 50% of cases, and usually follows rupture of the tympanic membrane. However, it may develop following a dilatation of the tympanic membrane into the tympanic cavity with the membrane still intact. In rare instances, it may develop from spread of infection up the eustachian tube. Resolution of the otitis externa is unlikely unless the otitis media is appropriately treated, which in some instances may necessitate surgery.

PRACTICAL POINTS IN THE APPROACH TO THE PATIENT WITH OTITIS

A thorough history alongside a complete general physical and dermatological examination should be undertaken. This should also include assessing the patient for any predisposing causes.

Significant pain should be anticipated when examining the ears and adaptations made to accommodate as necessary (e.g., consider postponing the otic examination until adequate pain-relief and anti-inflammatory medication has been administered and use of sedation or general anaesthesia, if required). As established earlier, the majority of these cases are likely to be recurrent in nature and so both clinician and owner will need to retain the ability to handle

the dog's ears; therefore, in addition to safeguarding the dog's immediate welfare, this action is essential to prevent a fearful response and aversion to future ear handling and so should be prioritised.

The otic examination should include otoscopy and examination of swabs from the ear canal to look for evidence of parasites, bacteria, yeast and inflammatory infiltrate. If this is the first occurrence of the condition and no primary cause can be readily identified, the clinician may elect for symptomatic treatment. However, all recurrent and / or chronic cases must be subjected to a work up for allergy – both for CAD and food allergy. To evaluate the response to treatment, otoscopy and cytology should be repeated and used for monitoring at an interval determined by the severity and nature of the problem.

KEY POINTS

- **Otitis externa in dogs is an extremely common condition that requires a systematic approach embracing the multifactorial nature of its pathogenesis.**
- **The PSPP-system (primary, secondary, predisposing and perpetuating) is used to categorise contributing factors to the condition.**
- **Canine atopic dermatitis (CAD) is the most prevalent and important primary cause of otitis externa, followed by food allergy; all recurrent and / or chronic cases must be subjected to a work up for both these conditions.**

REFERENCES

1. O'Neill DG *et al.* PLoS1 2014; 9(3): e90501
2. O'Neill DG *et al.* Canine Med Genet 2021; 8:7
3. Summers JF *et al.* BMC Vet Res 2019; 15: 163
4. Halliwell RE *et al.* Vet Dermatol 2021; 32: 8-e2
5. Saridomichelakis MN *et al.* Vet Dermatol 2007; 18: 341
6. Paterson S. Vet Dermatol 2002; 14: 249
7. Favrot C *et al.* Vet Dermatol 2010; 21: 23
8. Pico F *et al.* Vet Dermatol 2008; 19: 150-155
9. Rosser EJ. J Am Vet Med Assoc 1993; 259
10. Proverbio D *et al.* J Small Anim Pract 2010; 51: 370
11. Griffin C. In: Miller WH, Griffin CE, Campbell KL (Eds) Muller and Kirk's Small Animal Dermatology, Elsevier, St Louis Missouri, 2013; 746