



PREVALENCE OF EAR DISEASES IN DOGS – A RETROSPECTIVE 5-YEAR CLINICAL STUDY

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Summary

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The purpose of the present study was to present the results from a retrospective study on the prevalence of ear diseases among 5870 dogs referred for examination and treatment at the Small Animal Clinic at the Faculty of Veterinary Medicine, Stara Zagora, Bulgaria from January 1, 2010 to December 31, 2014. According to the results, ear diseases were significantly less prevalent in dogs aged up to 1 year ($P=0.0012$) and between 9–12 years ($P=0.0019$), but predominated in male dogs ($P=0.0206$). Ear diseases were more frequently observed in Cocker Spaniels (20.77%; $P<0.0001$), Bulgarian Shepherd dogs (17.91%; $P<0.0001$), Shar Pei (15.58%; $P<0.0001$), Kangals (11.76%; $P=0.0240$), Dogo Argentino (10.81%; $P=0.0351$) and French Bulldogs (9.35%; $P=0.0041$). Dogs from breeds with pendulous ears were more commonly affected. The diseases were more frequently unilateral (63.94%; $P<0.0001$), with clear effect of the season and higher prevalence during the summer (38.29%). Among all ear diseases, inflammations were the predominating pathology (67.90%).

Key words: dogs, ear diseases, otitis, prevalence

INTRODUCTION

Dogs with diseases of the ears comprise a substantial part of patients in modern small animal clinics. Depending on the affected part of the organ, inflammatory conditions (otitis) are divided into external (Otitis externa), middle (Otitis media) and internal (Otitis interna). External otitis is encountered in 8.7% of animals seen in veterinary clinics (Masuda *et al.*, 2000) and could affect from 10 to 20% of dog population (Angus, 2004; Cole, 2004).

Otitis media is most frequently encountered as a secondary complication to external otitis – in 50% to 80% of cases (Cole *et al.*, 1998). The same study affirmed that the disease was observed also when tympanic membrane was intact (in 71% of patients).

Internal otitis is a more severe inflammation of internal ear structures and vestibular apparatus, manifested with nervous signs and often, with Horner syndrome (de Lahunta & Glass, 2009).

The main condition in canine ears established after trauma is the auricular haematoma – blood effusion between the cartilage and the skin consequently to a ruptured blood vessel.

Neoplastic diseases of ears include both primary ceruminous tumours and growths that could affect the skin at any other site. Those originating from the Eustachian tube epithelium or the ear canal and from skull nerve endings are very rare (Rossmeisl, 2009). Most neoplasms in dogs are benign but malignant are also encountered. Devaney *et al.* (2005) classify ear neoplasms into external, middle and internal ear tumours.

Various foreign bodies could occur in the lumen of the external ear canal. The associated clinical signs depend on the type and origin of the bodies, their localisation, shape and size, and the presence of pathological process (Rosser, 2004).

The purpose of the present study was to present the results from a retrospective study on the prevalence of ear diseases among dogs referred for examination and treatment at the Small Animal Clinic at the Faculty of Veterinary Medicine, Stara Zagora, Bulgaria from January 1, 2010 to December 31, 2014. The influence of breed, age, weight, shape and size of ears, sex of animals was also investigated, as well as the distribution of cases according to the localisation, season and type of disease.

MATERIALS AND METHODS

The information for the study was obtained from the patients' records of 5870 dogs with surgical diseases referred for examination at the Small Animal Clinic, Faculty of Veterinary Medicine – Stara Zagora, Bulgaria between January 1, 2010 and December 31, 2014. Among them,

269 dogs were diagnosed with ear diseases on the basis of disease history and clinical examination.

All dogs with ear diseases were divided into groups according to their breed, age, body weight and sex. The dogs from 4 breeds (Irish Setter, Poodle, Caucasian Shepherd and English Bulldog) with 3 patients from each breed, comprised a common group A. The breeds from Group B (2 patients from each breed) were seven: Cane Corso, Siberian Husky, Fox terrier, Boxer, Pug dog, Central Asian Shepherd, Rottweiler. Group C included single representatives of 17 different breeds.

Five age groups were formed: up to 1 year of age; from 1 to 4 years; from 4 to 8 years; from 9 to 12 years; and over 12 years of age. With respect to body size, dogs were divided into small breeds (up to 10 kg), middle sized (11–25 kg) and large breeds (over 26 kg). Mixed breeds were not included due to the great variations in their size.

With regard to ear shape and size, dogs were divided as per exterior standards and the classification of Bonham (2013) into 3 groups: with erect, semi-erect and dropped ears. The erect ears could be either small or large, and their tips are set upright and forward. Semi-erect ears have strong ear cartilages making them erect to a defined position, and their tips begin to fold forward or downward. The dropped (pendulous) ears are long, hanging down and could be with soft (e.g. in Setters) or solid cartilage (Airedale Terrier). Mixed breeds were excluded from this classification as well.

Data were analysed also with regard to the localisation of disease (unilateral – either the left or right ear affected; and bilateral). Seasonal effects were evaluated according to the astronomical seasons:

Table 1. Distribution of ear diseases in dogs (n=269) according to the breed

Breed	Patients from the breed	Dogs with ear diseases	Within-breed prevalence (%)	% from all dogs with ear diseases
Cocker Spaniel	207	43	20.77%	15.99%
Bulgarian Shepherd dog	67	12	17.91%	4.46%
Shar Pei	77	12	15.58%	4.46%
Kangal	34	4	11.76%	1.48%
Dogo Argentino	37	4	10.81%	1.48%
French Bulldog	107	10	9.35%	3.71%
Golden Retriever	143	11	7.69%	4.09%
Pitbull	160	10	6.25%	3.71%
Jack Russell Terrier	65	4	6.15%	1.48%
Labrador Retriever	150	9	6.00%	3.35%
German Shepherd	550	30	5.45%	11.15%
Bolognese	157	8	5.10%	2.99%
Mixed breed	671	33	4.92%	13.39%
Drahthaar	155	6	3.87%	2.25%
Chow-Chow	89	4	4.49%	1.48%
Kurzhaar	98	4	4.08%	1.48%
Bulgarian Hound	173	4	2.31%	1.48%
Yorkshire Terrier	185	4	2.16%	1.48%
Pincher	546	11	2.01%	4.09%
Group A*	164	12	7.32%	4.47%
Group B*	718	14	1.95%	5.21%
Group C*	574	17	2.93%	6.32%

*Group A – three patients from each of 4 different breeds; group B – two patients from each of 7 different breeds; group C – one patient from 17 different breeds.

spring – March Equinox to June Solstice; summer – June Solstice to September Equinox; autumn – September Equinox to December Solstice; and winter – December Solstice to March Equinox.

Another classification divided the patients according to the specific ear disorder: foreign bodies, trauma, inflammation, tumours. Two patients (one in 2013 and one in 2014) presented two ear diseases at the same time, so the total number of diagnoses was 271.

The differences between categorical variables were evaluated by Chi-square analysis. The effects of different factors on the occurrence of ear diseases were examined with univariate logistic regression. Odds ratios (ORs), as a quantitative

measurement of association between the occurrence of disease and a given factor, and 95% confidence intervals (CIs) for the ORs were calculated (MedCalc v.10.2.0.0, MedCalc Software, Belgium).

RESULTS

Diseases of the ears have been diagnosed in 269 dogs or 4.58% (out of a total number of 5,870).

During the period of the survey, dogs affected with ear diseases were from 48 different breeds (Table 1). The highest number of dogs with ear diseases were from the Cocker Spaniel breed (43 or 15.99% of all patients). Second came mixed breed dogs (36 or 13.39%) and at

the third place: German Shepherds (30 dogs or 11.15% of affected ones).

When the number of patients with ear diseases was compared to the number of all dogs with surgical problems from the same breed referred to the clinic, the highest morbidity rate was observed again in Cocker Spaniels (20.77%), followed by Bulgarian Shepherd dogs (17.91%), Shar-Pei (15.58%), Kangal (11.76%), Dogo Argentino (10.81%), French Bulldog (9.35%) etc. The univariate logistic regression analysis proved that these 6 breeds were associated to 3 to 7 times higher risk of ear diseases (Table 5).

The age of patients was another factor with statistically significant effect ($P=0.024$). Most of animals affected with ear diseases were between 1 and 4 years of age (107 dogs or 39.78%), followed by

those between 4 and 8 years of age (87 dogs; 32.34%), puppies younger than 1 year (39; 14.50%). The share of elderly dogs from patients with ear diseases was the least (22 or 8.18% from the age group 9–12 years and 14 or 5.20% over 12 years of age). The comparison of affected dogs within their age group (Table 2) showed that the group between 4 and 8 years of age had the highest morbidity rate (5.85%), followed by 1–4 years of age (5.56%), over 12 years of age (3.60%). The proportion of dogs with ear diseases under 1 year of age was 3.08%. Compared to the 1–4 years old group, puppies under 1 year and dogs aged 9–12 years were associated with almost twice lower risk of ear diseases ($P=0.001$ and $P=0.002$ respectively; Table 5).

Table 2. Distribution of ear diseases in dogs (n=269) according to the age

Age groups	Total number of referred dogs	Dogs with ear diseases	Within-group prevalence (%)	% from all dogs with ear diseases
< 1 year	1266	39	3.08%	14.50 %
1–4 years	1925	107	5.56%	39.78 %
5–8 years	1488	87	5.85%	32.34 %
9–12 years	802	22	2.74%	8.18 %
> 12 years	389	14	3.60%	5.20 %
Total	5870	269	4.58%	100.00%

Table 3. Distribution of ear diseases in dogs (n=236) according to the shape of ears and body size

	Dogs with ear disease	Within-group prevalence (%)	% from all dogs with ear diseases
<i>Shape of ears</i>			
Erect	47	2.59%	19.92 %
Semi-erect	62	4.82%	26.27 %
Dropped	127	6.04%	53.81 %
Total	236		100.00%
<i>Body size</i>			
Small	41	2.56%	17.38 %
Middle-sized	90	7.19%	38.13 %
Large	105	4.48%	44.49 %
Total	236		100.00%

Table 4. Distribution of ear diseases in dogs (n=269) according to the sex

	Total number of referred dogs	Dogs with ear diseases	Within-group prevalence (%)
Male	3330 (56.73%)	172 (63.94%)	5.16%
Female	2540 (43.27%)	97 (36.06%)	3.82%
Total	5870 (100.00%)	269 (100.00%)	

Table 5. Univariate logistic regression analysis of the prevalence of ear diseases in 269 patients with respect to the breed, age and sex

Parameter	Odds ratio (OR)	OR (95% confidence intervals)	P
<i>Breed</i> (P<0.0001)			
Cocker Spaniel	7.44	5.15 to 10.75	<0.0001
Shar Pei	4.42	2.36 to 8.27	<0.0001
Bulgarian Shepherd dog	5.08	2.70 to 9.56	<0.0001
French Bulldog	2.65	1.36 to 5.16	0.0041
Dogo Argentino	3.07	1.08 to 8.70	0.0351
Kangal	3.34	1.17 to 9.51	0.0240
Golden Retriever	1.70	0.85 to 3.39	0.1304
All other breeds	–	–	–
<i>Age</i> (P=0.024)			
< 1 year	0.54	0.37 to 0.78	0.0012
1–4 years	–	–	–
5–8 years	1.06	0.79 to 1.41	0.7183
9–12 years	0.48	0.30 to 0.76	0.0019
> 12 years	0.63	0.36 to 1.12	0.1163
<i>Ear shape</i> (P<0.0001)			
Erect	0.41	0.29 to 0.58	<0.0001
Semi-erect	0.79	0.58 to 1.07	0.1330
Dropped	–	–	–
<i>Body size</i> (P<0.0001)			
Small	0.56	0.38 to 0.80	0.0017
Middle-sized	1.65	1.23 to 2.20	0.0007
Large	–	–	–
<i>Sex</i> (P=0.0238)			
Male	–	–	–
Female	0.74	0.57 to 0.95	0.0206

The distribution of patients with regard to their body size (body weight) (Table 3) showed that the predominant group were from large breeds (105 or 44.49% from all 269 dogs with ear diseases), fol-

lowed by middle-sized dogs (90 or 38.14%) and small dogs (41 or 17.37%).

The proportion of patients with ear diseases within the respective size group

however showed 7.19% morbidity rate in the middle-size group followed by large dogs with (4.48%). Compared to large dogs, the other size groups exhibited statistically significantly lower (for small breeds; $P=0.002$) or higher (for middle-sized breeds; $P=0.001$) risk of ear diseases (Table 5). Among the group of small-size patients, ear diseases comprised 2.56%.

With respect to the shape and size of ears, patients with dropped ears were the largest subgroup (53.81% of all dogs with ear diseases). At the second place were 62 dogs with semi-erect ears (26.27%) while the subgroup with erect ears was the least affected (47; 19.92%). The prevalence of ear diseases within the respective subgroups confirmed the susceptibility in dogs with dropped ears – this group comprised 2101 patients or 40.41% of all dogs with surgical diseases. Ear diseases were observed in 127 dogs or 6.04% from the dropped ear group. Compared to it, dogs with erect ears (morbidity rate 2.59%) suffered more that twice less frequently from ear diseases ($P<0.0001$). Ear diseases were demonstrated in 4.82% of dogs with semi-erect ears (Table 3).

Gender-related distribution of patients is presented in Table 4. This is a factor with considerable effect on the incidence of ear diseases in dogs ($P=0.0238$). Female dogs were significantly less affected with ear diseases ($OR=0.74$; $P=0.02$) than males. The number of bitches with ear diseases was 97 (36.06%) vs 172 (62.94%) in male dogs. The respective morbidity rates were 3.82% vs 5.16%.

The localisation of ears diseases (uni- or bilaterally) showed than in most instances, only one of ears was affected ($P<0.0001$): either the right (89 dogs; 33.08%) or the left (83 dogs; 30.86%). Both ears were diseased in 97 (36.06%) dogs.

Table 6. Distribution of dogs with ear diseases (n=269) according to the season of occurrence

Season	Number (%) of patients
Spring	49 (18.22%) ^{ac}
Summer	103 (38.29%) ^b
Autumn	78 (28.99%) ^{ab}
Winter	39 (14.5%) ^{ac}

Values with different superscripts are statistically significantly different at $P<0.05$.

Table 7. Distribution of dogs diagnosed with ear diseases (271 diagnoses)

Diseases	Number (%) of diagnoses
Inflammations	184 (67.90%) ^a
Foreign bodies	47 (17.34%) ^b
Traumas	32 (11.81%) ^b
Tumours	8 (2.95%) ^b

Values with different superscripts are statistically significantly different at $P<0.05$.

The seasonal distribution of patients with ear diseases (Table 6) showed the highest prevalence in the summer – 103 dogs or 38.29%. It was statistically significantly higher than the incidence of ear pathology in the spring (49 dogs; 18.22%; $P=0.02$) and winter (39 dogs; 14.50%; $P=0.01$). In 78 dogs (28.99%) ear diseases have occurred during the autumn.

According to the diagnosis (Table 7), the majority of patients suffered from inflammations of ears – external, middle or internal otitis (67.90%). Disorders due to the presence of a foreign body in the ear canal were established in 47 patients (17.34%) and those due to trauma came third in frequency (32 dogs; 11.81%). Neoplasms occupied the last place (8 dogs; 2.95%).

DISCUSSION

During the 5-year period of the retrospective study, 269 dogs were diagnosed with

ear diseases, e.g. observed morbidity rate was 4.58%. Another survey (Topalá *et al.*, 2007) has also established frequent although higher incidence of ear diseases – 8.7%.

The distribution of ear diseases among the different canine breeds showed that numerous breeds were affected. Most commonly, ear diseases were seen in Cocker Spaniels (15.99%) comparable to the observations of other researchers (Grono, 1969; Baba, 1981; August, 1988; Kiss *et al.*, 1997). This is attributed to the numerous apocrine glands in the ear canal of the breed. When a pathological process develops, they are activated, produce excessive amounts of cerumen and worsen the disease. Cocker Spaniels are a breed with pendulous ears, susceptible to ear diseases by reason of the reduced ventilation of the ear canal (McKeever *et al.*, 1997; Gotthelf, 2000). Inflammations are most commonly observed in connection with foreign bodies, traumas and neoplastic growths. Cocker Spaniels are reported to exhibit an increased incidence of plant awns as a cause of external otitis (Saridomichelakis *et al.*, 2007). The abundant hair in the ears of mixed breed dogs, Poodles, Terriers, German Shepherds etc. makes them prone to ear diseases and explain their increased prevalence found out in our survey as well as in other investigations (August, 1988; Logas, 1994; Gotthelf, 2000). Both Shar-Pei and Bulgarian Shepherd dog breeds had 4.46% morbidity rate. Shar Pei dogs are also prone to ear pathology due to a common abnormality leading to severe stenosis of the auditory meatus (Popovici, 2005).

The age of patients was another factor with pronounced ($P=0.024$) influence on the occurrence of ear diseases. Dogs between 1 and 4 years of age were most commonly affected (39.78%), followed by

those between 4–8 years of age (32.34%), in line with data stating that the age group 1–4 years was the most affected (Sharma & Rhoades, 1975) and the results of Carlotti *et al.* (1997), proving high percentage of ear inflammations in dogs between 1 and 5 years of age. In the study of Fernández *et al.* (2006), the highest prevalence of ear diseases has occurred in dogs from 2 to 5 years of age (43.4%). The same age group (1 to 5 years of age) exhibited the highest morbidity rate (85 affected out of 120 patients; 70.8%) in a similar research (Nardoni *et al.*, 2004). Other investigations reported the highest prevalence in dogs between 5 and 8 years (August, 1988; Carlotti, 1991) and 6–8-years old (Grono & Frost, 1969). These differences may be related to different criteria for allotment into groups, the purpose and housing conditions of dogs.

The classification of patients with ear diseases with respect to the body size showed that larger breeds were most commonly affected – Bulgarian Shepherd dog, Kangal, Dogo argentino, Golden Retriever, Pitbull etc. In most cases, these were working (guard dogs) living outdoor, including in less favourable hygienic conditions, which contributed to the more frequent incidence of ear diseases (McKeever *et al.*, 1997; Gotthelf, 2000; Saridomichelakis *et al.*, 2007).

With regard to the shape and size of ears, breeds with dropped ears were found to be predominantly affected with ear diseases (53.81%). The structure of the ears is essential for the occurrence, development and outcome of ear diseases in small animals, confirmed also by other studies (Sharma & Rhoades, 1975; August, 1988; Logas, 1994; Hayes *et al.*, 1987; Lehner *et al.*, 2010). The probable reason is the lack of proper ventilation in the ear canal due to its closure by the dropped pinna

and the maintenance of higher level of humidity (Nardoni *et al.*, 2008). Kihyang *et al.* (1999) however, reported a higher proportion of ear inflammations in dogs with erect and haired (43.2%) than in breeds with dropped ears (38.5%). In another study (Harvey *et al.*, 2004) the inner temperature in the ear did not influence the occurrence of diseases in the different types of ears as ear shape did not alter the temperature inside the meatus. It varied between 38.20 °C and 38.40 °C regardless of the dog breed, ear shape, size and motility.

The gender-related susceptibility demonstrated that male dogs were more susceptible and hence, the prevalence of ear diseases was significantly higher. These findings are comparable to many other reports (Kiss *et al.*, 1997; Chaudhary *et al.*, 2003; Phutane & Joseph, 2003; Nair, 2004; Mhatre, 2005; Kumar *et al.*, 2014). There are also investigations affirming that female dogs suffered more commonly from external otitis (Houdshell & Henssey, 1972; Carlotti, 1991). Hayes *et al.* (1987) did not observe any substantial differences between the genders with respect to the occurrence of *otitis externa* similarly to other studies which did not confirm sex predilection (Nuttal, 1998; Huang & Huang, 1999; Lehner *et al.*, 2010). To the best of our knowledge, no study has reported effects of sex hormones on the incidence of ear diseases. Yet, the more common fights between males suggest a higher prevalence of ear wounds, haematomas and traumas.

Ear diseases in dogs exhibited a clear seasonal pattern with a peak in the summer – 38.29%. Similar data have been published by Świącicka *et al.* (2015): 43% incidence of ear inflammation during the summer, 26.7% in winter, 15.7% in autumn and 14% in spring. This pattern

could be attributed to the specific climatic conditions, humidity, dust, parts of plants, more frequent bathing, high ambient temperature and longer and more frequent walks. Similar relationship between the frequency of ear inflammations and the climate, air humidity and plant blooming was reported by Staroniewicz *et al.* (1995) and Ziółkowska & Nowakiewicz (2004).

Ear inflammations were the predominant pathology and among them, external otitis. This is logical taking into account the large variety of primary and secondary factors predisposing to ear inflammations. The second most frequent cause for ear diseases were the foreign bodies in the ears and ear canal of dogs, caused by walks in grass areas, especially in Cocker Spaniels, which were the dogs most commonly diagnosed with foreign bodies in the ears.

CONCLUSION

According to the results of this retrospective 5-year study, ear diseases were more frequently observed in Cocker Spaniels, Bulgarian Shepherd dogs, Shar Pei, Kangals, Dogo Argentino and French Bulldogs. The prevalence among the age groups 5–8 years and 1–4 years was similar. Middle-sized dogs with dropped ears were considerably more prone to ear pathology, as well as males. Unilateral inflammations were also more common, and the largest group of patients was seen in the summer. Ear inflammations comprised the major part of all ear pathology types.

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