

Breed Variations in the Incidence of Pyometra and Mammary Tumours in Swedish Dogs

S Jitpean, R Hagman, B Ström Holst, OV Höglund, A Pettersson and A Egenvall

Department of Clinical Sciences, Swedish University of Agricultural Sciences, Uppsala, Sweden

Contents

Dogs enrolled in a Swedish insurance company (during 1995–2006) were studied for development of pyometra and mammary tumours (MTs), with special attention to breed and age. There were over 260 000 female dogs with over 1 000 000 dog-years at risk (DYAR) in the database, using data on bitches up to 10 years of age and 110 breeds with over 1000 DYAR. In total, 20 423 bitches were diagnosed with pyometra and 11 758 with MTs and 30 131 with either or both of the two diseases. The incidence rate (IR) for pyometra was 199 (95% CI 196–202), for MTs 112 (95% CI 110–114) and for either or both of the two diseases 297 (95% CI 294–301) dogs per 10 000 DYAR. The mean age of diagnosis pyometra was 7.0 years (SD \pm 2.2), MTs 8.0 years (SD \pm 1.6). In all breeds, the overall proportion of the bitches that developed disease by 10 years of age was for pyometra 19%, MTs 13%, and either or both of two diseases 30%. The top 10 breeds diagnosed with either or both of the two diseases were the Leonberger (73%), Irish Wolfhound (69%), Bernese Mountain Dog (69%), Great Dane (68%), Staffordshire Bull Terrier (66%), Rottweiler (65%), Bullterrier (62%), Doberman (62%), Bouvier des Flandres (60%), Airdaleterrier (60%). These data provide information of the combined disease incidence in a large number of different breeds. Breed variations in incidence rate suggests genetic components in disease development. Our study may be valuable in the search for genetic risk-factors or protective factors.

Introduction

Pyometra and mammary tumours (MTs) constitute the main reimbursement claims for veterinary costs in female dogs in Sweden (Egenvall et al. 1999, 2000). There are breed- and age-related differences in incidence of both diseases, but the combined risk has not yet been studied by breed (Egenvall et al. 2001, 2005). The Agria Insurance database (Stockholm, Sweden) has been used to investigate breed- and age-related risks for developing disease (Egenvall et al. 2000). The objective of the study was to evaluate the incidence of pyometra and MTs in this insured dog-population, up to 10 years of age, in relation to breed and age.

Materials and Methods

The insurance process, benefits and limitations of using insurance data in veterinary research has earlier been described in detail (Egenvall et al. 2000, 2009). The Agria Insurance database contains data from over 260 000 female dogs (\leq 10 years). In the present study, female dogs enrolled for both veterinary care and life insurance during 1995–2006 were included. Each year a dog was insured contributed to one dog-year at risk (DYAR). All insured bitches were considered at

potential risk for developing pyometra. Variables used were: gender, breed, date of birth, dates when dogs entered or left the insurance program, information on the type of insurance for which dogs were enrolled, and whether claims were reimbursed. Breeds were classified according to the Swedish Kennel Club breed classification system. If dogs had reimbursed claims for pyometra, they were considered as pyometra-cases and likewise for MTs. The crude- and breed-specific proportions (percentages) of dogs that had insurance claims for pyometra or MTs up to certain ages (6, 8, and 10 years) were calculated using the base-line survival statement from Cox regression (without independent variables). Incidence rates, crude and breed-specific mean ages were calculated for development of pyometra and MTs and either or both of the two diseases.

Results

The database contained data from over 260 000 female dogs, resulting in just over 1 000 000 DYAR calculated for dogs up to 10 years of age. There were 110 breeds with over 1000 DYAR in the database, constituting the basis for the analyses. In total, data from 20 423 bitches diagnosed with pyometra, 11 758 with MTs, and 30 131 with either or both of the two diseases were obtained from the database. The incidence rate (IR) for pyometra was 199 (95% CI 196–202) dogs per 10 000 DYAR, for MTs 112 (95% CI 110–114) dogs per 10 000 DYAR and for either or both of the two diseases 297 (95% CI 294–301) dogs per 10 000 DYAR. The mean age of diagnosis pyometra was 7.0 years (SD \pm 2.2), for MTs 8.0 years (SD \pm 1.6) and for either or both of the diseases 7.4 years (SD \pm 2.1). The proportion of bitches diagnosed with either or both of the two diseases ranged from 9 to 73% in different breeds. The proportion of the bitches that developed these diseases at 10 years of age was for pyometra 19%, MTs 13%, and either or both pyometra or MTs 30%. There were 20 breeds with a proportion of at least 50% affected by either or both of the two diseases at 10 years of age (Table 1). In the supplementary tables (S1–S3), all breeds are ranked according to the proportion that developed either of or both the diseases (pyometra and MT) by the age of 10 years.

Discussion

It is common practise to insure dogs in Sweden and approximately 40% of all dogs are covered by Agria Insurance. Approximately 90% (all ages) of the Swedish dog population is intact, hence most dogs are susceptible to reproductive organ disease (Egenvall et al.

Table 1. (continued)

| Breed | Pyometra % ^{rank} (n) | MTs % ^{rank} (n) | P/MTs % ^{rank} (n) | Total female dogs |
|--------------------------------|-----------------------------------|------------------------------|--------------------------------|-------------------------|
| West Highland White Terrier | 24 ⁴⁹ (205) | 8 ⁸⁴ (64) | 30 ⁷¹ (255) | 2067 |
| Whippet | 23 ⁵⁵ (82) | 10 ⁸⁰ (35) | 30 ⁷⁰ (112) | 1173 |
| Yorkshire Terrier | 21 ⁶¹ (157) | 25 ²⁴ (176) | 39 ³⁶ (301) | 1959 |

The 110 breeds are listed in alphabetical order. The breeds are ranked according to the proportion of disease(s) within each breed (rank 1 = highest proportion). Total female dogs column describes the number of dogs in each breed that contributed to the number of dog-years at risk included in the analysis.

1999). The Agria database thus offers unique possibilities for studies concerning such diseases. The incidences of pyometra and MTs have been shown to vary between different breeds, suggesting a genetic background (Egenvall et al. 2001; Rivera et al. 2009). The overall proportion of dogs that had developed pyometra in this study was slightly lower (19%) than previously reported (23–24%) which possibly reflects that more low-risk breeds were included in the present study (Egenvall et al. 2001). Although based on different study periods, the overall proportion of dogs developing MTs in the present study was 13%, which is the same as in a previous report (Egenvall et al. 2005). In some breeds (i.e. the Leonberger and the Great Dane), the risk for both diseases was high, indicating that predisposing factors may be similar. In contrast, other breeds had a relatively high risk for MTs (i.e. the English Springer Spaniel and the American Cocker Spaniel, ranked 5 and 6, respectively), but were only ranked as number 30 and 23 for pyometra. The Bernese mountain dog (highest rank for pyometra) was ranked as 57 for MTs. These findings suggest that there is breed variation in risk-factors or protective factors. Though complex diseases with probable multifactorial aetiology, the data reported here may be useful for the selection of breeds in future studies for identification of factors that may be protective or increase the risk for the development of pyometra and/or MTs.

Elective spaying is commonly performed in many countries, and will prevent development of pyometra, and depending on at which age the surgery is performed, also have a protective effect for MTs (Schneider et al. 1969). However, recently the protective effects by spaying on MT development have been questioned (Beauvais et al. 2012). In the present study, high incidences (up to 73%) of pyometra and MTs were demonstrated in some giant and large breeds of which are commonly affected by post spaying urinary incontinence (Thrusfield et al. 1998). Since the pros and cons of elective spaying will vary by breed, knowledge of

breed-variations will be clinically useful in the decision process for each dog.

Due to insurance age limitations, only data from dogs up to 10 years of age are included in the database, which is a study limitation. The true mean ages of diagnosis and incidences are likely to be higher and larger, respectively, and especially in breeds with long life expectancy.

Conclusion

In the present study the incidence of pyometra and MTs in Swedish female dogs up to 10 years of age is reported. For the first time data on contracting either or both of the two diseases was studied in a comparatively large population of 110 breeds. Substantial between-breed variation in the incidence of pyometra and MTs was demonstrated. These differences indicate that genetic factors may predispose and/or protect for disease development. These results may be valuable for future genetic studies or breeding programs aimed to decrease the prevalence in high-risk breeds.

Acknowledgements

Agria Pet Insurance kindly allowed us to use their database. Financial support was provided by Thure F. and Karin Forsbergs Research Foundation, M. Forsgrens Research Foundation and Agria Insurance and The Swedish Kennel Club Research Foundation.

Conflicts of interest

None of the authors have any conflicts of interest to declare.

Author contributions

All authors were involved in the study design, performance and manuscript preparation. AE performed statistical analyses and SJ drafted the manuscript.

Supporting Information

Additional Supporting Information may be found in the online version of this article:

Table S1. Rank, breed, proportion (%) of bitches in different breeds that had developed pyometra by the age of ten years. The 110 breeds are listed in ranking order.

Table S2. Rank, breed, proportion (%) of bitches in different breeds that had developed mammary tumours by the age of ten years. The 110 breeds are listed in ranking order.

Table S3. Rank, breed, proportion (%) of bitches in different breeds that had developed either pyometra or mammary tumours or both of the two diseases by the age of ten years. The 110 breeds are listed in ranking order.

References

- Beauvais W, Cardwell JM, Brodbelt DC, 2012: The effect of neutering on the risk of mammary tumours in dogs: A systematic review. *J Small Anim Pract* **53**, 314–322.
- Egenvall A, Hedhammar A, Bonnett BN, Olson P, 1999: Survey of the Swedish dog population- Age, gender, breed, location and enrolment in animal insurance. *Acta Vet Scand* **40**, 231–240.
- Egenvall A, Bonnett BN, Olson P, Hedhammar A, 2000: Gender, age and breed pattern of diagnoses for veterinary care in insured dogs in Sweden during 1996. *Vet Rec* **146**, 551–557.
- Egenvall A, Hagman R, Bonnett BN, Hedhammar A, Olson P, Lagerstedt AS, 2001: Breed risk of pyometra in insured dogs in Sweden. *J Vet Intern Med* **15**, 530–538.

Egenvall A, Bonnett BN, Ohagen P, Olson P, Hedhammar A, von Euler H, 2005: Incidence of and survival after mammary tumors in a population of over 80,000 insured female dogs in Sweden from 1995 to 2002. *Prev Vet Med* **69**, 109–127.

Egenvall A, Nodtvedt A, Penell J, Gunnarsson L, Bonnett BN, 2009: Insurance data for research in companion animals: benefits and limitations. *Acta Vet Scand* **51**, 4.

Rivera P, Melin M, Biagi T, Fall T, Haggstrom J, Lindblad-Toh K, von Euler H,

2009: Mammary tumor development in dogs is associated with BRCA1 and BRCA2. *Cancer Res* **69**, 8770–8774.

Schneider R, Dorn CR, Taylor DO, 1969: Factors influencing canine mammary cancer development and postsurgical survival. *J Natl Cancer Inst* **43**, 1249–1261.

Thrusfield MV, Holt PE, Muirhead RH, 1998: Acquired urinary incontinence in bitches: its incidences and relationship to neutering practices. *J Small Anim Pract* **39**, 559–566.

Submitted: 29 May 2012; Accepted: 24 Jul 2012

Author's address (for correspondence): S Jitpean, Department of Clinical Sciences, Swedish University of Agricultural Sciences, Box 7054, 75007 Uppsala, Sweden.
E-mail: suprancee.jitpean@slu.se