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A retrospective study of pyometra at five RSPCA hospitals in the UK: 1728 cases from 2006 to 2011

A. Gibson, R. Dean, D. Yates, J. Stavisky

A retrospective cross-sectional study was used to analyse pyometra cases at five RSPCA Animal Hospitals across the UK from 2006 to 2011. A total of 1728 cases of pyometra were recovered from a female dog outpatient caseload of 78,469 animals, giving a total prevalence of 2.2 per cent over the study period. There was an annual increase in the incidence of pyometra within the population, while elective ovariohysterectomy caseload has declined. There were variations in breed and age at presentation. Bullmastiffs (P < 0.0001), golden retrievers (P = 0.001) and dogue de Bordeaux (P = 0.008) were over-represented in the pyometra population when compared with the female dog outpatient caseload. Mean age at presentation was 7.7 years. Some breeds presented at a significantly lower age, including dogue de Bordeaux (mean age 3.3 years) and bullmastiffs (mean age 5.4 years), while others presented as older dogs, including Yorkshire terriers (mean age 9.4 years) and border collies (mean age 10.3 years). Surgical mortality rate at the Greater Manchester Animal Hospital was 3.2 per cent. Pyometra is of significant welfare concern, and also has cost implications, particularly in charity practice. These results serve to highlight this condition so that future change in charity practice caseload can be anticipated and strategies can be directed to improve animal welfare.

Introduction

Pyometra

Pyometra is a common, potentially life threatening condition, affecting entire female dogs. The disease is defined by accumulation of purulent material within the uterus, which manifests in both local and systemic symptoms, and demands costly surgical or medical intervention in order to resolve (Dow 1958, Sandholm and others 1975, Hagman and others 2011). Uterine exposure to progesterone during canine dioestrus plays a key role in the pathogenesis of the disease (Dow 1958). Progesterone induces changes in the uterus which prepare a suitable environment for early embryo development, including endometrial proliferation, increased uterine glandular secretions and decreased myometrial contractions, as well as a relaxation in normal uterine cellular immune defences (Teunissen 1952, Sugiura and others 2004, Noakes and others 2009). Consecutive oestrus cycles have a cumulative effect on the endometrium which can lead to the development of cystic endometrial hyperplasia which has been shown to predispose for the development of pyometra (Dow 1958), however, the two conditions can occur independently (De Bosschere and others 2001).

Prevalence/incidence

An accurate incidence of pyometra within the at-risk un-neutered female dog population is difficult to attain due to the large proportion of neutered dogs within the pet population. Egenvall and others (2001) reported an overall annual pyometra incidence of 2 per cent from a study of approximately 200,000 predominantly un-neutered Swedish dogs, with around 24 per cent of dogs having experienced pyometra by 10 years of age. A retrospective study of 3536 dogs in the UK reported an upper limit for pyometra incidence of 2 per cent per year within the at-risk population (Whitehead 2008), whereas, a study of 165 colony-reared beagles reported a prevalence of 15.2 per cent over the dogs’ lives (Fukuda 2001).

Age

Pyometra has consistently been shown to predominantly affect middle-aged to older dogs, with mean age at presentation ranging from 6.4 to 9.5 years (Dow 1958, Ewald 1961, Hardy 1974, Wheaton and others 1989, Sevelius and others 1990, Niskanen and Thrusfield 1996, Egenvall and others 2001, Fukuda 2001, Whitehead 2008, Igna 2011, Hagman and others 2011). The disease can occur from the time of the first season and has been reported in dogs as young as six months of age (Stone and others 1988).

The Royal Society for Prevention of Cruelty to Animals (RSPCA) has five charity animal hospitals around the UK which provide veterinary services to members of the public who are in receipt of specific state benefits and are unable to afford private treatment for their pets. In common with other animal welfare charities, the RSPCA is
Prevalence was calculated for each year, and a total period prevalence was calculated for the study period. The prevalence was also calculated for each breed, to allow interbreed comparison. Incidence was similarly calculated as a yearly rate.

Analyses were carried out in SPSS V.16.0 for Windows. Significance was set at P<0.05. For estimation of breed differences in prevalence of pyometra presentation, the proportion of that breed present in the pyometra population was compared with the proportion of the same breed present in the FDO population, and the \( \chi^2 \) test for proportions (with Yates’s correction) applied.

For comparison of the different ages at which different breeds were presented for pyometra, the Bonferroni correction was used so that 98.8% (1 to 0.05/22) CIs were calculated, in order to correct for the effect of repeated comparisons.

Results

Prevalence

A total of 1728 cases presented with pyometra in the six-year period of study, and 8374 dogs underwent OVH. The total FDO population was 75,469 dogs. Table 1 summarises the results for each hospital.

The overall period prevalence of pyometra was 2.2 per cent.

Prevalence within breed

Fig 1 summarises the period prevalence of pyometra within breeds with 10 or more pyometra cases. Prevalence of pyometra over the six years of study was highest in bullmastiffs and golden retrievers at 6.4 per cent and 5.4 per cent, respectively. Bullmastiffs, golden retrievers and dogue de Bordeaux had a significantly higher prevalence of pyometra than the general population (\( P<0.0001, \ P=0.001 \) and \( P=0.008, \) respectively).

Incidence

The annual incidence for pyometra and OVH were calculated as a percentage of FDO (Fig 2). The pyometra incidence increased annually from 1.8 per cent of the FDO in 2006 to 2.9 per cent in 2011. Within individual hospitals, the incidence of pyometra increased over the study period at GMAH, HAH and PAH, while staying constant at MAC and decreasing slightly at BAH. Other than PAH, the rate of elective OVH, as a percentage of FDO, decreased at all hospitals over the study period with an overall decrease from 11.7 per cent to 9.1 per cent.

Age

The mean age at presentation for pyometra was 7.7 years, with a range of 0.6–19 years, as shown in Fig 3. There was variation in the age at presentation within breeds. Dogue de Bordeaux (n=14) had a mean age at presentation of 5.3 years (99.8% CI 2.3 to 4.3), and bullmastiffs (n=45) presented at a mean age of 5.4 years (99.8% CI 4.3 to 6.6). Conversely, the mean age of Yorkshire terriers (n=63) was 9.4 years of age (99.8% CI 8 to 10.9), and border collies was 10.3 years (98.8% CI 8.8 to 11.9). Fig 4 shows a box-and-whisker plot of age at pyometra presentation within breeds with 10 or more cases, covering 1586 dogs.

Data analysis

Data of each group was collated into a spreadsheet (Excel V.5.0; Microsoft) and duplicate case numbers were removed. Breeds were defined by categories set in the hospital database. All crossbreeds were grouped into a single category for breed data analysis. Incidence and prevalence were calculated using the FDO population as the denominator.
It is clear that in the RSPCA hospital population, at least, elective neutering has decreased over recent years. One might expect neutering uptake in charity practice, where neutering has a lower cost to the owner, to increase in a time of economic recession as people with financial constraints seek alternative avenues to private practice. The reported decrease in elective OVH in this study may represent a shift in public perception of neutering, or a decreased priority when finances are limited. At GMAH, there has been an increase in the amount of off-site neutering performed over the study period (unpublished data), which may explain reduced numbers of OVH performed at the hospital. Capacity for elective neutering throughout at each hospital would also be affected by hospital factors such as staffing and budget. The PDSA Animal Wellbeing Report 2012 estimated that 52 per cent of dogs in the UK are un-neutered, however, this had decreased from 34% in the PDSA PAWS Report 2011 (PDSA and YOUGOV, 2011, 2012). Personal belief and wanting to breed from their pet were primary factors given by dog owners for electing not to neuter, however, awareness of the risk of reproductive-related problems and their financial and welfare consequences were not evaluated. Owner education is essential, so that an informed decision regarding neutering can be made, and potential future reproductive problems can be anticipated and planned for. It is especially important given how commonly such problems occur; for example, in a study of predominantly un-neutered female dogs, around 24 per cent of them had experienced pyometra, and 15 per cent had developed mammary tumours by the age of 10 years (Egenvall and others, 2001, Egenvall and others, 2005).

The majority of cases presented to RSPCA hospitals are first presentations, with 51.2 per cent of cases of pyometra at GMAH being neither registered at GMAH nor referred from another veterinarian. These may be pet owners who had been previously registered at another veterinary practice, or owners who had no previous veterinary contact. In a survey of over 3900 pet owners, the PDSA Animal Wellbeing Report 2012 reported that 7 per cent of dogs were not registered with a veterinary practice, and 14 per cent had never received a primary course of vaccinations, however, this is likely to be higher in areas of low income (PDSA and YOUGOV, 2012). There is particular concern for the welfare of these animals and it is challenging to evaluate this population, as they are not in contact with the veterinary profession until there is a problem. The PDSA Animal Wellbeing Report does, however, document an overall positive trend in the uptake of preventative medicine and registration to veterinary practices since 2011 (PDSA and YOUGOV, 2012).

There was an increased prevalence of pyometra within bull-mastiff, golden retriever and dogue de Bordeaux, when compared with the presence of these breeds in the FDO population. A genetic predisposition for pyometra has not been demonstrated, however, a number of studies have described over-representation within certain breeds, including rottweiler, golden retriever and Cavalier King Charles spaniel (Krook and others, 1960, Niskanen and Thrushfield, 1998, Egenvall and others, 2001). Other breeds which have inconsistently been described as being over-represented include Saint Bernard, bernerese mountain dog, rough collie, miniature schnauzer, great Dane, chow chow, pointer, Irish terrier and French bulldog (Krook and others, 1960, Ewald 1961, Niskanen and Thrushfield, 1998, Egenvall and others, 2001). On the other hand, dachshunds have repeatedly been reported to have decreased incidence of pyometra (Krook and others, 1960, Ewald 1961, Niskanen and Thrushfield, 1998, Egenvall and others, 2001). The pyometra population in this study may be skewed by an increased likelihood of referral of large breed dogs to charity practice due to the higher cost of surgery compared with smaller breeds. Further investigation would be needed to assess whether this indicated a true breed predisposition.

### Age

In the present study, the mean age at pyometra presentation of 7.7 years is consistent with previous studies (Dow 1938, Ewald 1961, Wheaton and others 1989, Sevelius and others 1990, Niskanen and Thrushfield, 1998, Egenvall and others, 2001, Hagman and...
Significant variation in age at pyometra presentation between breeds has not been previously reported, however, in this study, dogue de Bordeaux and bullmastiffs presented at a significantly younger age than other breeds. Egenvall and others (2001) reported no significant difference in the age at which dogs of different breeds presented with pyometra, however, the study only included dogs up to the age of 10 years, and so these figures may be skewed for breeds which have a higher mean age of pyometra presentation. It was discussed that in some breeds the risk of pyometra may increase more and at a younger age than others, potentially as a result of a genetic predisposition (Egenvall and others 2001). Interestingly, in the present study, border collies and Yorkshire terriers were presented at a significantly higher age than the population mean. Hagman and others (2011) found no correlation between risk of pyometra and short interoestrus interval, early fertility or irregular oestrus cycles, indicating that the number of seasons an animal is exposed to during its lifetime does not relate to risk of pyometra. This may suggest a physiological reason for increased susceptibility in some breeds, such as variation in uterine secretion, myometrial contractions or uterine immune response during dioestrus.

Clinical outcomes at GMAH
The mean mortality rate of dogs undergoing surgical treatment of pyometra at GMAH was 3.2 per cent (range 2.0–5.2 per cent), which is in line with previous estimates of 0 per cent, 5 per cent and 17 per cent mortality reported in studies of surgical cases in the 1980s (Hardy 1974, Stone and others 1988, Wheaton and others 1989) and 4.3 per cent (death or euthanasia) reported by Egenvall and others (2001). Although pyometra mortality rate is relatively low, morbidity through duration of disease, hospitalisation and surgery also have welfare implications. In a study of 116 cases of pyometra, Hardy and others reported a mean duration of illness of 12 days (range 1–180), with a number of studies documenting depression (73–86 per cent), anorexia (72–79 per cent) and vaginal discharge (74–88 per cent) as the most frequent clinical signs (Hardy 1974, Wheaton and others 1989, Sevelius and others 1990).

Treatment of pyometra inevitably carries a significant financial duty to the owner. The cost of treatment at GMAH is subsidised by the RSPCA, however, clients are still charged a proportion of the
FIG 3: Age at pyometra presentation in 1723 cases of pyometra presented at five Royal Society for Prevention of Cruelty to Animals animal hospitals from 2006 to 2011. The solid vertical line denotes median age (7.9 years). The dotted lines denote lower quartile (5 years) and upper quartile (10 years). Five cases were excluded from the total of 1728 as age data was not available.

FIG 4: Box-and-whisker plot of age at presentation of pyometra within breed in female dogs presented to Royal Society for Prevention of Cruelty to Animals animal hospitals from 2006 to 2011. Only breeds with group sizes greater than ten are shown (n=1586 in 22 breeds). The boxes show the mean and 99.8% CIs, and the whiskers show the range. The horizontal line indicates the population mean (7.7 years) cost of treatment. The average charge to the client was £100.65 per pyometra case in this study. Despite this subsidised cost to the owner, GMAH was unable to recover 39 per cent (£27,760) of fees charged to clients for treatment of pyometra over the six-year study period, something which would not be sustainable in private practice. This gives an insight into the scale of the problem of pyometra, especially in areas of low income, and raises the question of what might happen to these animals if charitable veterinary care were to become less available in the future. One of the major findings of the PDSA Pet Welfare Report 2012 was a lack of awareness of the cost of pet ownership, and this was cited as the primary concern of practitioners relating to pet care (PDSA and YOUGOV 2012). It is therefore essential that efforts are made to ensure that pet owners are aware of potential future costs and how they can be planned for through insurance, preventative
The authors are grateful to Laurie Curtis for her assistance in gathering data from RSPCA computerised records. The Centre for Evidence-based Veterinary Medicine is supported by an unrestricted grant from Novartis Animal Health, and The University of Nottingham.

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**References**


DOW, C. (1985) The cystic hyperplasia-pyometra complex in the bitch. _The Veterinary Record_ 117, 1102–1110


IGNA, V. (2011) Associations between hormonal therapy, pyometra, and canine mammary tumours. _Lucrari Stiintifice - Universitatea de Stiinte Agricole a Banatului Timisoara, Medicina Veterinara_ 44, 33–40


RSPCA (2011) RSPCA Trustees’ Report and Accounts 2011


TEUNISSEN, G. H. (1952) The development of endometritis in the dog and the effect of oestradiol benzoate. _The Veterinary Record_ 69, 25–26

**TABLE 2: Analysis of GMAH pyometra population (n=699)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of pyometra cases</th>
<th>Died (%)</th>
<th>PV ref (%)</th>
<th>Average cost per case to client (£)</th>
<th>Total loss through non-payment (£)</th>
</tr>
</thead>
<tbody>
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<td>2006</td>
<td>77</td>
<td>5.2</td>
<td>26.0</td>
<td>88.5</td>
<td>2496.73</td>
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<tr>
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<td>2.4</td>
<td>15.7</td>
<td>89.6</td>
<td>4175.41</td>
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<tr>
<td>2008</td>
<td>106</td>
<td>2.8</td>
<td>26.4</td>
<td>91.6</td>
<td>3870.90</td>
</tr>
<tr>
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<td>3.8</td>
<td>36.4</td>
<td>98.3</td>
<td>6343.11</td>
</tr>
<tr>
<td>2010</td>
<td>151</td>
<td>2.0</td>
<td>28.5</td>
<td>112.9</td>
<td>7066.95</td>
</tr>
<tr>
<td>2011</td>
<td>150</td>
<td>3.3</td>
<td>36.0</td>
<td>123.1</td>
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</tbody>
</table>

Discussion

Pyometra is a preventable disease, and veterinary treatment is required if an affected animal is to survive. As the recession continues, efforts need to be made to ensure that animal welfare within the pet population does not deteriorate, however, reaching populations that are outside of veterinary guidance will be particularly challenging. Therefore, the authors believe that it is essential to educate new owners to the potential risk of pyometra, as well as investigating effective methods of owner education in areas of poor veterinary compliance.

**Acknowledgments**

The authors are grateful to Laurie Curtis for her assistance in gathering data from RSPCA computerised records. The Centre for Evidence-based medicine and responsible pet ownership in order to avoid compromising welfare later in the animal’s life. Further research is warranted into the demand for charity veterinary services, particularly relating to preventable problems, such as pyometra, as well as investigating effective methods of owner education in areas of poor veterinary compliance.

**Limitations**

The limitations of this study need to be considered when interpreting the results. The pyometra population may have been underestimated by searching invoiced procedures, as the data would not include animals which presented with pyometra, but were not invoiced for ‘pyometra spay’. This would include cases which were euthanased or died prior to having surgery, or those which were managed medically; however, pyometra was routinely treated surgically at the hospitals in the study. This would also result in an underestimation of calculated pyometra mortality rate. Furthermore, the mortality rate calculation would not include animals whose death was not recorded in the GMAH medical notes, for example, any that died at home or represented to the referring veterinary practice for postoperative complications.

The neuter status within the FDO population was not reliably recorded in the computer system, and so the control population contained both neutered and entire female dogs. Therefore, the reported incidence of pyometra is likely to be an underestimate of the actual incidence, as the denominator includes spayed female dogs (which would not be at risk of pyometra). On the other hand, the total at-risk population is likely to be larger than the hospital population, as many animals will only be presented to veterinary practice when they become unwell, as is the case with pyometra. The ideal control group would be a wider population of dogs from the hospital catchment areas, although sampling this population would be difficult as they have no known previous veterinary contact.

Breed data may have been affected by high incidence of breed-related (non-pyometra) disease within the FDO population. For example, a high number of cases presenting for skin disease within a specific breed would relatively reduce incidence of pyometra. Additionally, there may be a larger proportion of un-neutered female dogs within certain breeds due to variation in owner perception of OVH or intention to preferentially breed certain types of dogs, therefore resulting in a greater proportion of females at-risk of pyometra.

**Conclusion**

Pyometra is a preventable disease, and veterinary treatment is required if an affected animal is to survive. As the recession continues, efforts need to be made to ensure that animal welfare within the pet population does not deteriorate, however, reaching populations that are outside of veterinary guidance will be particularly challenging. Therefore, the authors believe that it is essential to educate new owners to the potential risk of pyometra, especially those who are likely to rely heavily on charities for veterinary care. Further research is required to identify potential breed predispositions, and investigate effective ways of promoting responsible pet ownership in underprivileged areas of the UK.
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