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A Retrospective Study of Pyometra in Canines

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ABSTRACT

The present study has been undertaken to investigate the prevalence of pyometra and document variation in breed and age of dogs vis-à-vis pyometra through a retrospective study. Data pertaining to all dogs presented for treatment of pyometra between 2016 and 2021 were gathered from electronic records maintained at University Veterinary Hospital. During the study period, a total of 4502 dog outpatient caseloads having reproductive problems were presented in the hospital, out of which 336 dogs suffered from pyometra, resulting in a prevalence of 7.5 percent. Within breed, the prevalence was higher in Saint Bernard (71.4%), Tibettan Mastiff (54.5%) and Dalmation (43.7%) and lower in Golden Retriver (5.0%) and German Shephard (3.4%). The age at presentation was lower in Tibettan Mastiff (1.5±0.5 years) and Pug (2.9±0.4 years) and higher in Dalmation (10.5±0.5 years) and Pomeranian (7.4±1.4 years) breeds of dogs. Neutrophilia (95.8%), anemia (87.7%), leukocytosis with left shift and increased levels of alkaline phosphatase (96.7%), blood urea nitrogen (75%) and creatinine (84.2%) appeared to be characteristic hematological and biochemical findings, respectively in pyometra. Maximum caseloads were presented during spring (32.7%), followed by autumn (20.5%), summer (16.9%), monsoon (16.7%) and winter (13.0%). The most common complication associated with pyometra included kidney malfunction (84.2%). Ovariohysterectomy is the treatment of choice in most caseloads (86.6%). The overall incidence of mortality due to pyometra was 12.2 percent. Vaginal swab bacteriological examination revealed the predominance of *Escherichia coli* (66.7%). These observations serve to highlight the importance of public awareness regarding pyometra in canines.
Keywords: Canine, Pyometra, Retrospective study

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INTRODUCTION

Pyometra is a common life-threatening disease of intact female dogs characterized by accumulation of purulent pus material within the uterus. It occurs due to hormonal imbalance of the uterus along with bacterial superinfection. Progesterone plays a key role in the pathogenesis of canine pyometra during diestus period. Diagnosis of pyometra is

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based on anamnesis, physical examination, hemato-biochemical laboratory findings in combination with ultrasonographical findings of ovaries and uterus (Hagman 2018). The common findings include neutrophilia with left shift, monocytosis, leukocytosis, hypoalbuminemia along with affected liver and renal fuctions (Hagman 2012). However, adding analyses that are not routinely performed in clinical work may be time consuming and the cost benefit must be considered. Clinical signs like vomition, decreased appetite, distension of abdomen and abdominal pain are commonly observed in dogs suffering from pyometra with or without peritonitis. The values of clinical parameters and variables routinely available like case history data, clinical signs and symptoms, physical examination and laboratory findings have yet not been fully explored as indicators of outcome after surgical correction of pyometra (Jitpean *et al.,* 2014). The occurance of canine pyometra is more frequent in middle-aged to older intact dogs, which adversely affects the life of dogs and brings an economic loss to their owners (Verstegen *et al.,* 2008). The treatment of choice for pyometra affected dogs is ovariohysterectomy (Gibson *et al.,* 2013). However, post-surgery life-threatening complications occur in pyometra like sepsis, septic shock, hemorrage, disseminated bacterial infection and peritonitis. Thus, to avoid surgery and also to maintain the fertility, several medical treatments have been preformed to treat pyometra which includes dopamine agonists, progesterone receptor antagonist and prostaglandins with variable success (Crane, 2014). It is, therefore, significant to review trends in the presentation of such diseases so that the necessary action can be taken to improve animal welfare and look forward to changing caseloads of the future. Keeping in view of above, the present retrospective study in canines was undertaken through secondary collection of data pertaining to pyometra cases presented for treatment at University veterinary hospital from January 2016 to December 2021 to investigate the prevalence of pyometra, document variation in breed and ages of dogs vis-à-vis pyometra, describe complications of pyometra and explore several variables that may be useful as an indicator of peritonitis after surgery.

MATERIALS AND METHODS

Case study review, case history data, physical examination and laboratory findings: This study was approved by the Institutional Animal Ethics Committee of the University (GADVASU/2022 IAEC/65/02). Data were gathered from electronic records maintained at the University Veterinary Hospital. All the dogs presented to the University hospital by local public for treatment of pyometra between January 2016 and December 2021 were included in the present study. Detailed examination of dogs suspected of having pyometra included collection of vaginal swabs for bacterial culture, blood sample estimations for hematology and biochemistry, ultrasound scanning of abdomen (kidneys and reproductive organs) as well as measurement of external diameter of uterine horn and visualization of pus pockets, review of previous medical treatment, if any, and necessity to undergo surgery based on clinical signs and symptoms along with severity of condition.

Statistical analysis: Statistical evaluations were carried out using SPSS V.16.0 for Windows. Data obtained from the retrospective investigation were tabulated and a percent analysis was computed. Prevalence was calculated for each year, each breed and age of dog to allow interbreed comparison. Breed differences in prevalence of pyometra presentation, risk factors within case history, physical examination, laboratory data and signs of peritonitis were analyzed by Chi-Square test and Fisher's exact test. For comparison of the different ages at which different breeds were presented for pyometra, the Bonferroni correction was used. The data generated were expressed in percentage. A confidence level of $P<0.05$ was considered significant in all variables.

RESULTS AND DISCUSSION

Anamnesis, physical examination and laboratory findings: The case history, physical and clinical examination of 336 dogs with pyometra and their percentages are shown in Table 1. Clinical findings of fever, dehydration, palpable enlarged uterus and pale visible mucous membrane were observed in most caseloads. The laboratory analyses in 336 dogs suffering from pyometra and their percentages have been presented in Table 2. The most common haematology parameters in dogs suffering from pyometra are neutrophilia and anaemia along with leukocytosis with left shift, monocytosis and band neutrophils. Clinical biochemistry revealed increased levels of alkaline phosphatase, blood urea nitrogen, creatinine and bile acids in pyometra affected dogs. Previous studies (Jitpean *et al.,* 2014; Shah *et al.,* 2017) have also documented anorexia, vaginal discharge, leucopenia, polydipsia, polyuria, pyrexia, vomiting, diarrhoea, urinary tract infection and leucocytosis with neutrophilia and left shift as common sequelae to pyometra.

Table 1: Case history physical and clinical findings in dogs affected with pyometra

Variable	Number of female dogs with respective pyometra finding	Percentage
Case history		
Vaginal discharge	299	88.9
Anorexia	312	92.8
Depression	254	75.5
Polydipsia	301	89.5
Polyuria	203	60.4
Vomiting	276	82.1
Lameness	83	24.7
Diarrhea	73	21.7
Urinary tract infection	47	13.9
Clinical findings		
Fever	126	37.5
Dehydration	94	31.7
Abdominal pain on palpation	51	15.1
Palpable enlarged uterus	248	73.8
Hyperemic mucus membrane	53	15.7
Pale mucus membrane	172	51.1
Hypothermia	43	12.7

Table 2: Laboratory and biochemical analyses in dogs affected with pyometra

Variable	Number of female dogs with respective pyometra finding	Percentage
Laboratory analyses (Hematology)		
Anemia	295	87.7
Normochromic regenrative anemia	216	64.2
Neutrophilia	322	95.8
Leucocytosis	194	57.7
Monocytosis	169	50.2
Leukocytosis with left shift	274	81.5
Band neutrophils	197	58.6
Toxic neutrophils	82	24.4
Leucopenia	47	13.9
Neutropenia	52	15.4
Monocytopenia	14	4.1
Clinical Biochemistry		
Increased alkaline phosphatase	325	96.7
Increased bile acids	235	69.9
Increased lactate	19	5.6
Increased blood urea nitrogen	252	75
Increased creatinine	283	84.2
Hypoglycemia	23	6.8
Hyperglycemia	17	5

Prevalence of pyometra: Table 3 summarises the results pertaining to the prevalence of pyometra and elective ovariohystectomy during the six years of study. A total of 4502 female dog outpatient (FDO) caseloads were presented for treatment of various reproductive problems. Out of these, 336 cases were affected with pyometra, resulting in an overall period prevalence of 7.5%. The period prevalence of pyometra was lowest in 2017 and highest in 2020 and increased exponentially from 7.1% in 2016 to 10.0% in 2021. During the study period, 417 dogs underwent ovariohystectomy (OH), out of which 291 surgeries were performed due to pyometra and the remaining 126 as elective ovariohystectomy (EOH). The proportion of dogs with pyometra having open cervix was 89.0% and that with closed cervix was 11.0%. The overall period prevalence of pyometra was higher (2.2%) than a previous report by Gibson *et al.,* 2013 but lower (24%) than that reported by Egenvall *et al.* (2005). There was a steady annual increase in the prevalence of canine pyometra from 2016 to 2021. The yearly increase in pyometra caseloads could be related to a number of factors, like economic recession, owing to which most pet owners rely on government veterinary hospitals for treatment of such unexpected, expensive conditions especially during the COVID and post COVID period. Neutering uptake in government hospitals offers a lower cost to the owner (Gibson *et al.,* 2013).

Table 3: Female dog outpatient (FDO), pyometra, ovariohysterectomy (OH) and elective ovariohysterectomy (EOH) from 2016 to 2021

Year	Female dog outpatient (FDO)	Pyometra affected dogs	Number of OH due to pyometra (OHP)	EOH	Period pyometra prevalence
2016	396	28	12	9	7.1
2017	568	7	3	2	1.2
2018	712	34	28	8	4.8
2019	834	39	37	6	4.7
2020	843	113	110	33	13.4
2021	1149	115	101	68	10.0

Prevalence within breed: The prevalence of pyometra among different breeds has been shown in Fig. 1. Breed prevalence was calculated using the number of dogs presented with pyometra as the numerator and FDO for each breed as denominator presented for treatment of any reproductive problem at the hospital. During the years 2016-2021, a total of 24 different breeds were diagnosed with pyometra. The overall prevalence of pyometra was higher in pug and Labrador and lowest in Shitzu and Dogue de Bordeaux. The period prevalence of pyometra within breeds was calculated with 5 or more pyometra cases (Fig. 2). Within breed, the prevalence was higher in Saint Bernard, Tibetan Mastiff, Dalmatian and lower in Golden Retriever and German Shepherd. Potentially, the prevalence of pyometra was 29.8% in small, 63.1% in medium and 7.1% in large breeds of dogs. A number of studies (Arendt *et al.,* 2021; Hui and Primarizky, 2017) have established a higher prevalence of pyometra in various breeds including Golden Retriever, Rough-coated Collie, Siberian Husky, Cocker Spaniel, Rottweiler, German Shepard, Miniature Schnauzer, Beagle, Cavalier King Charles spaniel, Mongreal, Silky Terrier, Toy Poodle, Chow Chow and Pekingese. In the current study, significant variation in age at pyometra presentation was observed between breeds with Tibetan mastiff and Pug presented at a younger age while Dalmatian and Pomeranian presented at a higher age as compared to other breeds. Likewise, variation in age at pyometra presentation was observed in different breeds including Dogue de Bordeaux (3.3 years), Bull mastiff (5.4 years), Yorkshire terrier (9.4 years) and Border collies (10.3 years; Gibson *et al.,* 2013).

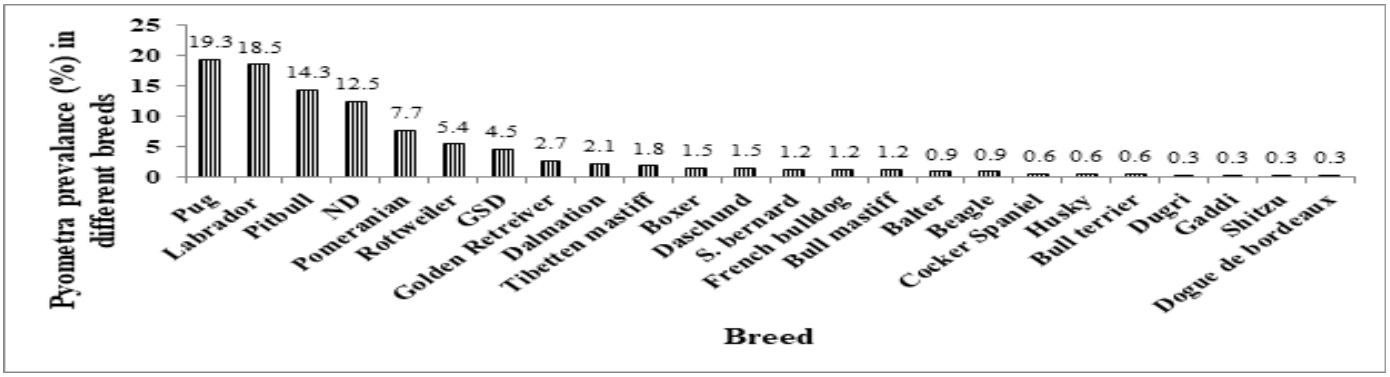

Fig. 1: Overall prevalance of pyometra in female dogs presented from 2016-21

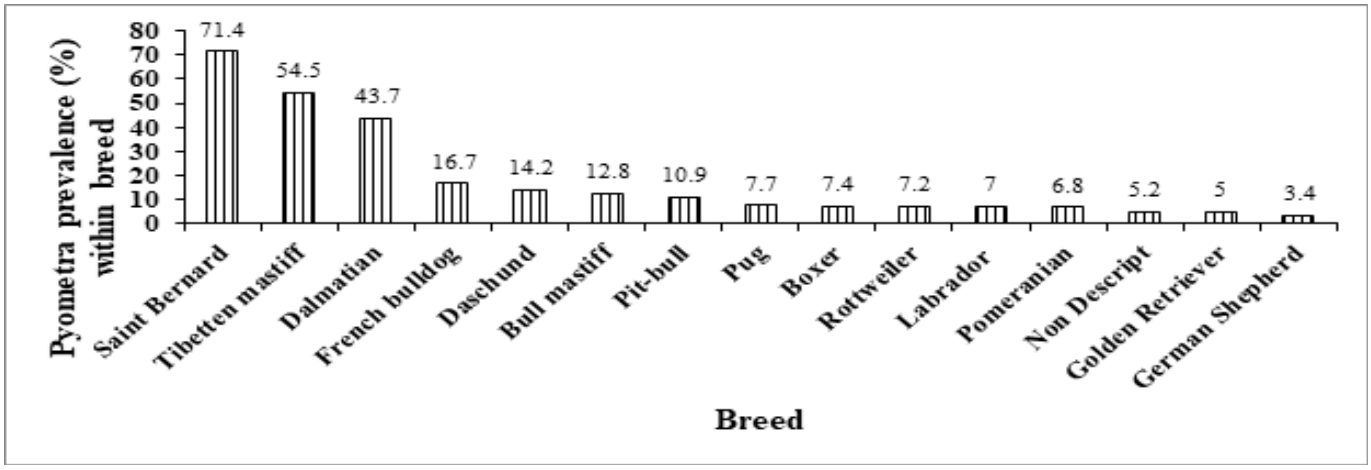

Fig. 2: Period prevalance of pyometra within breed in female dogs presented from 2016-21

Prevalence with age: The mean age at presentation for pyometra was 5.6±0.2 years, with a range of 1-14 years. There was variation in the age at presentation within breeds. The mean age at presentation was lower in Tibetan mastiff (1.5±0.5 years, n=6) and Pug (2.9±0.4 years, n=65) breeds and higher (P<0.001) in Dalmatian (10.5±0.5 years, n=7) and Pomeranian (7.4±1.4 years, n=26) breeds of dogs. Variation in age at pyometra presentation was observed in different breeds including Dogue de Bordeaux (3.3 years), Bull mastiff (5.4 years), Yorkshire terrier (9.4 years) and Border collies (10.3 years) in an earlier report by Gibson *et al.* (2013). Population of dogs with pyometra was highest in middle aged dogs (5.1-8 years, n=153; 45.5%), followed by young aged dogs (1.1-5 years, n=141; 42.0%) and least in old dogs (8.1 years and more, n=42; 12.5%). Previous studies have shown that the incidence of pyometra was 24.36% in dogs below 5 years of age, 39.75% between 5 to 10 years of age and 35.89% in those above 10 years of age (Chouksey *et al.,* 2022). About 37% of Swedish Golden Retrievers were affected with pyometra by the age of 10 (Arendt *et al.,* 2021).

Prevalence with season: During the years 2016-2021, the pyometra caseloads with respect to season have been presented in Table 4. Maximum caseloads were presented during spring (32.7%), followed by autumn (20.5%), summer (16.9%), monsoon (16.7%) and winter (13.0%). Monthly recordings depicted higher pyometra caseloads in the months of April (14%), November (11.6%) and March (11%) and lower during January (6.3%), August (6.3%) and September (3.2%). Previous studies have also shown higher incidence of pyometra caseloads during autumn and spring months (Laurusevičius *et al.,* 2009; Stančić *et al.,* 2012). The occurrence of pyometra after the last estrus is precisely associated with the influence of different durations of daily photo period and different ambient temperatures in different seasons (Stančić *et al.,* 2012).

Table 4: Pyometra cases presented during different seasons and months of year

Season/Month	Pyometra case presentation	Percent
Season		
Winter	44	13.0
Spring	110	32.7
Summer	57	16.9
Monsoon	56	16.7
Autumn	69	20.5
Month		
January	21	6.3
February	26	7.7
March	37	11
April	47	14
May	25	7.4
June	32	9.5
July	24	7.1
August	21	6.3
September	11	3.2
October	30	8.9
November	39	11.6
December	23	6.8

Mortality: The incidence of mortality during the study period has been presented in Table 5. The overall mortality due to pyometra was 12.2% (41/336) while the mortality following surgery as a means to treat pyometra was 11.7% (34/291). Of the dogs that died postoperatively, mortality

due to concomitant diseases including kidney malfunction was noticed in 8.9% (n=26/291), severe hepatic disease associated with ascites in 4.1% (n=12/291) and long-term polyuria/polydipsia in 1.0% (n=3/291) caseloads. None of the dogs were euthanized owing to poor prognosis of pyometra. Similar studies have reported mortality of 1% (Pailler *et al.,* 2022), 3.2% (Gibson *et al.,* 2013) and 10% (Jitpean *et al.,* 2014) in pyometra affected dogs. Further, Hagman *et al*. (2007) and Kuplulu *et al*. (2009) demonstrated 5-27% post-operative mortality in dogs suffering from pyometra. Although the mortality rate due to pyometra is relatively low, morbidity during the duration of the disease has welfare implications.

Complications in pyometra dogs: Complications reported in 336 dogs with pyometra included kidney malfunction (84.2%, n=283), hepatic disease associated with ascites (40.2%), persistent polyuria/polydipsia (81.5%), peritonitis (3.0%), cardiac arrhythmia (5.3%) and uveitis (0.9%). Specific prolonged post-operative complications were observed in 69.4% (n=202/291) dogs. These complications included wound infection (22.7%, n=66/291), dehiscence (12.8%, n=37/291), urinary tract infection (5.5%, n=16/291), peritonitis (6.5%, n=19/291) and off feed (14.8%, n=43/291). Previous studies have documented anorexia, vaginal discharge, polydipsia, polyuria, pyrexia, vomiting, diarrhoea and urinary tract infection as common sequelae to pyometra (Jitpean *et al.,* 2014). A striking result was that leucopenia was associated with an increased risk of peritonitis. However, peritonitis was not more common in older dogs. This indicated that age by itself is not a risk factor for surgical treatment of pyometra (Bille *et al.,* 2012). These results made leucopenia the most important clinically identified biomarker. Leucopenia could be caused by chronic inflammatory disease and loss of leucocytes to the uterine lumen is usually associated with high mortality (Jitpean *et al.,* 2014). Other than leucopenia, fever and hypothermia were present which is linked to peritonitis. Interestingly, lameness was present in 24.7% of the dogs. It is possible that the activated immune response could trigger arthritis (Arendt *et al.,* 2021). Laboratory findings, leucocytosis with neutrophilia and left shift, were observed in most dogs which is in consonance with the findings of previous study by Arendt *et al.* (2021).

Occurrence of pyometra in relation to mating history and onset of estrus: Out of 336 pyometra affected female dogs, 254 had a previous history of mating. The maximum caseloads of pyometra occurred in the dogs in which mating did not happen (64.2%), followed by dogs in which mating was done but the female did not conceive (22.8%). The remaining 13.0% of dogs encountered pyometra after whelping. The occurrence of pyometra and its association with estrus was recorded in 295 dogs. Most dogs (39.7%, n=117/295) affected with pyometra had a history of estrus 16-30 days back. The occurrence of pyometra in dogs 31-60 days after onset of estrus was 32.2% and in those with more than 60 days after estrus was 22.7% (n=67/295). The dogs with less than 15 days after the onset of estrus exhibited least proportion of pyometra (5.4%, n=16/295). The occurrence of post-coital pyometra could be due to unhygienic conditions leading to infection in the favourable environment during the impending diestrus. Nulliparous animals compared to pleuriparous animals showed higher incidence of pyometra (Sethi *et al.,* 2020). Likewise, Juneja *et al.* (2021) also revealed that the occurrence of pyometra was highest in nulliparous, followed by primiparous and multiparous dogs. High incidence of pyometra after 16-60 days of estrus reflected that pyometra is primarily a disease of diestrus phase which accounted for 71.9%. Similar studies have shown the occurrence of pyometra about 45 days after the last estrus (Laurusevičius *et al.,* 2009). During long-term diestrus of the dog, there is elevation of progesterone concentration in the body that inhibits the defense mechanism of the uterus (infiltration by polymorphonuclear leukocytes; Roseboom *et al.,* 1998).

Treatment of pyometra: Ovariohysterectomy was the treatment of choice in most pyometra cases (86.6%). In the remaining 13.4% of dogs, medical treatments were performed to treat pyometra, success of which was defined as return to a clinically healthy status. The success rate did not differ significantly between young (≤5 years, 58.0%) and old dogs (>5 years, 42.0%). During the study period various therapeutic regimens used for treatment of pyometra included dopamine agonist (9.8%), progesterone receptor antagonist (0.9%), prostaglandin (1.2%) and combination of progesterone receptor antagonist along with prostaglandin (1.5%). The mean cost to the client for treatment of pyometra increased annually from 2016 to 2021, with an average cost of as Rs. 5691.5 (Table 5). Treatment of pyometra inevitably carries a significant financial implication on the owner. This gave an insight into the scale of the problem of pyometra. It is, therefore, essential that efforts are made to ensure that pet owners are aware of potential future costs documented. The demand for charity veterinary services, particularly relating to preventable problems, including pyometra is need of the hour Gibson *et al.* (2013).

Table 5: Analysis of mortality due to pyometra caseloads

Year	2016	2017	2018	2019	2020	2021
Total number of caseloads died	3	0	7	4	10	17
Mortality (%)	10.7	0	20.5	20.5	8.8	14.7
Number of pyometra affected caseloads that died following surgery	1	0	2	0	2	4
Mortality following surgery (%)	3.6	0	5.9	0	1.8	3.5
Cost per case to client (Rs)	4872	4921	5021	5285	6218	7772

Bacteriological findings and antimicrobial sensitivity/ resistance in pyometra affected dogs: Common bacterial isolates from culture of vaginal swabs performed in 27 out of 336 caseloads revealed *Escherichia* coli (66.7%), *Staphylococcus* aureus (22.2%), *Klebsiella pneumoniae* (7.4%) and *Pseudomonas aeruginosa* (3.7%) in pyometra affected dogs. The cultures were tested for antimicrobial susceptibility and were classified as sensitive and resistant considering the zone of inhibition of diameter observed. Gentamycin seemed to be most sensitive (77.8%) followed by Amikacin (74.0%) and Enrofloxacin (70.4%). Alternatively, Penicillin G (96.3%), Streptomycin (77.8%) and Amoxicillin (70.4%) exhibited higher resistance. Resistance to ampicillin and penicillin may be associated with the frequent use of these antibiotics in veterinary practice during the treatment of severe infections in dogs (Robaj *et al.,* 2016). On the contrary, higher sensitivity for amoxicillin, cephalosporins and potentiated sulfonamides was observed by Verstegen *et al.* (2008) and Bassessar *et al.* (2013) who found that the isolates of *Escherichia coli* and *Staphylococcus aureus* were sensitive to gentamicin and enrofloxacin. Bacteria responsible for persistent infection such as pyometra often incorporate nosocomial resistance plasmids (Chang *et al.,* 2014).

CONCLUSION

Thus, pyometra is a preventable disease which requires immediate intervention for animals to survive. Complications such as kidney malfunction, wound infection and peritonitis, etc., are observed in dogs with pyometra. Efforts need to be made to ensure that animal welfare within the pet population does not deteriorate. It is, therefore, essential to educate pet owners about the potential risks of pyometra.

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CONFLICT OF INTEREST

The authors do not have any conflict of interest.

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