Incidence of Pyometra in Colony-raised Beagle Dogs

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Abstract: Incidence of pyometra observed in our colony-raised beagle dogs over a 12-year period is described. Pyometra was observed in 25 female dogs of more than 4 years old, frequently at 8–11 years, with the average age of onset 9.36 ± 0.38 years. The incidence of the disease was 15.2% of the female dogs (n=165) more than 4 years old. Clinical findings useful in the diagnosis of this disease included an excretion of pus from the cervix, rapid increase in leukocyte count, and enlarged uterus as revealed by radiography. The relationships of delivery, estrus cycles to this disease are discussed. Ovariohysterectomy or uterectomy was the only effective method of treatment. In conclusion, the results indicated that pyometra might be an age-related disease because it occurred particularly in aged dogs.

Key words: beagle dogs, clinical findings, pyometra

Introduction

Since 1974 in our institute, we have been breeding beagle dogs for life-long radio-toxicological studies in order to clarify physiological and pathological characteristics, and to assess their usefulness as animal models of bone metabolism [4–7, 9]. The features of clinical findings including disorders at an early period when the generation of dogs was young in our colony have reported [4]. Thereafter, various diseases accompanying increases in age have been observed.

Pyometra is one of the diseases sometimes observed in female dogs, but detailed clinical features such as the incidence, clinical signs and age of onset have remained unknown [1–3, 8].

The purpose of the present study was to determine the characteristics of pyometra based on the clinical records of our colony-raised beagle dogs.

Materials and Methods

Beagle dogs were bred under room temperature, 22 ± 2°C, in a relative humidity of 55 ± 5%, a 12 hr light-dark cycle with artificial sun rays, and air condition of all air fresh supply. The dogs were kept in a cage that was washed every day. Dogs were fed daily 250 g of a standardized food (shared AM: 150 g and PM: 100 g, Funabashi Farm Co., DM-1).

Periodical health checks were performed which included the following: routine observation of food and water intake, and condition of feces and urine; the animal’s body weight measurement every month; blood and serum biochemical examinations every three months. In addition, careful observations were performed for the dogs revealing any untoward findings. Estrus in all female dogs was checked against the individual breeding record including the estrus cycle, and...
by the observation of vaginal smear. The pus excreted from the cervix was collected every day and the smear was examined to distinguish it from estrus, based on the changes in cells during the estrus and the number of bacteria.

After pyometra was suspected by smear observation, the dog underwent detailed checks, whether estrus was expected or not, for clinical findings such as body weight and appetite, frequent blood examination, and x-ray radiographs. According to the changes in clinical signs, treatment using transfusion and antibiotics was performed. Ovariomyectomy or uterectomy after the diagnosis was carried out when necessary.

Results

Pyometra was observed in twenty-five dogs over the course of 12 years (1988–1999). The average age of the affected dogs was 9.36 ± 0.38 years, frequently between 8–11 years, and the age of all cases was more than 4 years. The incidence of this disease was 15.2% in all dogs (n=165) that lived more than 4 years (Fig. 1). The relationship between parturition and this disease was examined: 15 dogs had not littered, while 10 dogs had littered 1–3 times from 1 year to 4 years and 7 months (Table 1). This disease was not observed after mating and during pregnancy.

The relationship between the disease and estrus cycle was examined in detail. The average of estrus cycle intervals was 8.0 ± 0.2 months (n=25), except for the estrus just before the attack of pyometra. The average length just before the onset of pyometra was prolonged to 14.7 ± 3.1 months, because that of 5 dogs was 45.4 ± 6.6 months, ranging from 28.5–60.0 months while 20 dogs showed 8.9 ± 0.8 months. The average length of time from the end of estrus just before the disease to the attack in 25 dogs was 3.9 ± 1.3 months, in which it was 1.5 ± 0.3 months in 21 dogs and 17.5 ± 3.9 months, ranging from 7.0–26.0 months in 4 dogs.

The excretion of pus from the cervix was observed at 0–26 days before operation (ovariohysterectomy or uterectomy) in 18 out of 25 dogs (Fig. 2). The findings in three dogs were obscure due to the disease following estrus. Four dogs did not excrete pus. The pus was cream-colored, reddish brown. Tests for bacteria in the pus showed only non-specific bacteria such as staphylococcus and escherichia coli. The toxins of bacteria in serum from some cases were not detected.

The observation of the uterus by x-ray photography was performed on 21 dogs at 0–17 days before operation (ovariohysterectomy or uterectomy) in 18 out of 25 dogs (Fig. 2). The findings in three dogs were obscure due to the disease following estrus. Four dogs did not excrete pus. The pus was cream-colored, reddish brown. Tests for bacteria in the pus showed only non-specific bacteria such as staphylococcus and escherichia coli. The toxins of bacteria in serum from some cases were not detected.

The observation of the uterus by x-ray photography was performed on 21 dogs at 0–17 days before operation. Radiographs showing enlarged images of the uterus providing clear diagnoses in all cases. Blood examination also helped to diagnose the disease, particularly the rapid elevation of leukocyte count. Fig. 3 shows the change in leukocyte count before and after
operation. The value at 1 month before operation was used from the record of the periodical blood examination or after any suspected untoward signs. The time course of the elevation of the leukocyte count was variable, but the leukocyte count in almost all of the dogs increased to 30,000–40,000/mm$^3$ 2 weeks before operation and thereafter elevated rapidly. The operation was performed after the leukocyte count reached to 40,000–50,000/mm$^3$ in most of the dogs. The leukocyte count decreased rapidly and had returned to the baseline at 1 month after operation. However, three dogs whose leukocyte count was above 110,000/mm$^3$ after operation died within 2–21 days. Simultaneously, the erythrocyte count, hemoglobin, and hematocrit values decreased, while the value of plasma total protein increased before operation (Table 2).

In all dogs after ovariohysterectomy or uterectomy except three dogs, appetite began to recover within 1–3 days and then returned almost completely by 7–10 days. The values of blood constituents rapidly returned to the baselines before the onset of disease, as did the dogs’ body weights within 1 month (Figs. 3 and 4, and Table 2).

Food intake varied among individual dogs. In almost all of the dogs, appetite decreased or fell off several days before the operation. The body weights of dogs decreased rapidly accompanied with the decrease in food intake and changes in blood constitution (Fig. 4). Vomiting was not observed in any dogs before operation. The behavior of dogs also varied, generally decreasing several days before operation. Body temperature did not change, although some dogs showed

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**Table 2.** Changes in blood constituents before and after operation day (0*)

<table>
<thead>
<tr>
<th>Days</th>
<th>–30</th>
<th>–40</th>
<th>–7</th>
<th>–2</th>
<th>0*</th>
<th>+2</th>
<th>+7</th>
<th>+14</th>
<th>+30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erythrocyte count (10$^9$/ml)</td>
<td>681 ± 14</td>
<td>573 ± 18</td>
<td>532 ± 32</td>
<td>525 ± 15</td>
<td>520 ± 24</td>
<td>498 ± 24</td>
<td>472 ± 13</td>
<td>506 ± 14</td>
<td>572 ± 17</td>
</tr>
<tr>
<td>Hemoglobin (mg/dl)</td>
<td>16.6 ± 0.4</td>
<td>13.9 ± 0.4</td>
<td>13.3 ± 0.6</td>
<td>12.5 ± 0.4</td>
<td>12.8 ± 0.6</td>
<td>11.8 ± 0.5</td>
<td>11.4 ± 0.3</td>
<td>12.2 ± 0.3</td>
<td>14.0 ± 0.4</td>
</tr>
<tr>
<td>Hematocrit (%)</td>
<td>47 ± 1</td>
<td>40 ± 1</td>
<td>38 ± 2</td>
<td>36 ± 1</td>
<td>36 ± 1</td>
<td>34 ± 1</td>
<td>34 ± 1</td>
<td>36 ± 1</td>
<td>41 ± 1</td>
</tr>
<tr>
<td>Plasma Total protein (g/dl)</td>
<td>7.5 ± 0.2</td>
<td>8.3 ± 0.4</td>
<td>8.5 ± 0.4</td>
<td>8.2 ± 0.3</td>
<td>8.8 ± 0.6</td>
<td>7.9 ± 0.4</td>
<td>7.7 ± 0.3</td>
<td>7.5 ± 0.3</td>
<td>7.4 ± 0.3</td>
</tr>
</tbody>
</table>

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**Fig. 3.** Changes in the values of white blood cell count 30 days before and after operation (day 0). Values are mean ± SE (n-25).
temporarily over 39.0°C. Treatments using transfusion, antibiotics, e.g., gentamicin, kanamycin, tetracycline, chloramphenicol, streptomycin, penicillin, and prednisolone were not effective.

The final diagnosis was made according to the following three items: accelerated increase in leukocyte count, excretion of pus, and enlarged uterus as revealed on radiographs. Radiographic findings were particularly useful for confirming the disease in 21 cases. Two dogs experienced the onset of purulent metritis at the ages of 11 and 13 years, showing similar clinical findings, such as excretion of pus from the cervix and elevation of leukocyte count. X-ray images of the uterus were also useful in distinguishing pyometra from purulent metritis which expresses similar symptoms.

**Discussion**

The average age when the dogs experienced the onset of pyometra, 9.36 ± 0.38 years, was near to the average life-span, 9.95 ± 0.34 years, of the 128 deceased female dogs in our colony. The disease began at more than 4 years, and was frequently observed among 8–11-year-old dogs. Smith et al. [8] reported that this disease occurred frequently in dogs of more than 6 years, indicating that pyometra occurs in aged dogs.

The incidence of this disease in our colony was 15.2%. Andersen described that diseases of the genital tract are quite infrequent in beagle dogs. In their colony, 7 out of 245 beagle dogs (2.9%) died from pyometra and endometritis [1], and 2 out of 360 dogs (0.6%) received hysterectomy [2]. There were differences regarding the incidence of pyometra between their results and ours. As beagle dogs were kept in a so-called outdoor system in their colony, the median age of life of 220 dogs was 7.5 years, shorter than that of the 12.5 years in other laboratory systems [2], and the 9.95 years in our indoor system. In Anderson’s report, it was found that one dog died from pyometra at 12.1 years [2]. The lower incidence of pyometra in the former colony may be due to the dogs’ shorter life spans. However, the distinct explanations related to the length of dogs’ life span cannot be described here.

In our breeding system, clean conditions are maintained by washing cages every day in addition to a closed environment that is defended completely against infection imported from outdoors. Specific kinds of bacteria were not detected by the bacteria test, with common bacteria such as *staphylococcus* and *E. coli* which usually exist in the intestine being discovered. Okano et al. [10] reported that the endotoxin of bacteria in serum was elevated in dogs with pyometra. Although the results from the serum test for endotoxin were negative, endotoxin might play an important role in enhancing the severity of the condition in dogs, judging from the highly increased leukocyte count and the ineffectiveness of any kind of antibiotic. This suggests that the disease might occur due to a decrease in biological resistance in aged dogs.

Smith et al. [8] described that pyometra usually followed parturition. Parturition in 10 dogs shown in Table 1 had ceased by 55 months (4.6 years) old. The data showed that the pyometra tended to be induced more often in dogs with few parturitions, though this might be due to the fact that few dogs had littered many times in our colony. The littered dogs were attacked by pyometra 5–10 years after the last parturition except for one case of 2.5 years. The incidence of pyometra was higher in virgin dogs than the dogs that experienced parturition, as shown in Table 1. Therefore, the causes of the occurrence of this disease might be not related to parturition and parity. Copulation is considered to be one of the causes leading to this disease. However, copulation might be not related to the onset of this disease, since the pyometra was not observed after copulation in our colony.

The interval of estrus cycles before the occurrence of
pyometra was invariable. The average length of the last estrus cycle before the onset of pyometra was slightly prolonged, and those in 5 dogs were extremely prolonged. We confirmed the ends of the estrus period even in the aged dogs by the observation of smears. The disease had a tendency to occur after the long absence of a distinct estrus. The average length of time from the occurrence to the end of last estrus cycle was 3.9 months but frequently 0.5–2 months in many cases. Pyometra in three cases followed estrus. Therefore, one of the causes of pyometra may be related to the condition of the uterus affected by the ovarian function.

The first indication of this disease was often pus excretion from the cervix, as observed in 18 out of 25 dogs, although no pus excretion was observed in 4 cases. The finding was obscure in three dogs, because pyometra followed estrus. Pus excretion from the cervix could be confused with a common symptom of purulent metritis, since its age of onset and clinical findings are almost identical to those of pyometra, and antibiotics were ineffective. However, the volume of pus in purulent metritis was less than that in pyometra. The radiograph image of the uterus was a useful way of distinguishing pyometra from purulent metritis at our facility.

When pus excretion was observed, blood examinations, particularly to determine the change in leukocyte count at 3-day intervals were necessary to judge the physical conditions of dogs, as well as the body weight, activity and appetite. These findings helped confirm the diagnoses. However, other findings such as weakness of the hind legs, thirst, polyuria, dullness, anorexia, dehydration, vomiting, fever, and abdominal palpation were not observed in our colony, in contrast to the results of Bloom [3] and Smith et al. [8].

Ovariohysterectomy or uterectomy was determined as the optimal treatment [3]. Actually, 22 out of 25 dogs that underwent these operations were completely cured of this disease. However, three dogs, in which the leukocyte count was higher after the operation than before, died following operation. The earlier the operation was performed, the more quickly the dogs recovered.

In conclusion, these results indicate that pyometra might be an age-related disease in aged dogs, probably accompanying the lowering of physiological resistance with aging.

References