# Haemato-Biochemical and Sonographic Studies in open and Closed Cervix Pyometra

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[Received: 09.07.2019; Accepted: 21.04.2022]
{DOI 10.29005/IJCP.2022.14.1.14-17}

## ABSTRACT

*Pyometra is a life threatening and common metoestrual disease of middle-aged to older intact bitches. Twelve clinical cases suggestive open cervix pyometra (Gr.I, n=6) and closed cervix pyometra (Gr. II, n=6) were included in the study. Healthy dogs in dioestrus phase formed the control group (Gr. III, n=6). Detailed history, clinico-gynaecological findings were recorded. Ultrasonographic examinations and haemato-biochemical studies were carried out for confirmatory diagnosis. There was non-significant difference in the uterine horn diameter and uterine wall thickness between the open and closed cervix pyometra. However, distinct differences observed in the sonographic and haemato-biochemical findings between open and closed cervix pyometra.*

**Key words:** *Canine, Haemato-biochemical, Pyometra, Sonography*

## INTRODUCTION

Pyometra is recognized as the most prevalent and life threatening reproductive disorder among canines. It is a metoestrual disease of intact adult female dogs, characterized by uterine bacterial infection with pus accumulating in the uterus and systemic illness (Hagman, 2014). Closed cervix pyometra is a medical emergency, requirers rapid intervention to prevent overwhelming sepsis and save the life. Hence for the early diagnosis of pyometra, haemato-biochemical and ultrasonographic evaluation are important to initiate treatment and predicting the prognosis. Present study aimed at differentiating the haemato-biochemical and ultrasonographic changes between open and closed cervix pyometra.

## MATERIALS AND METHODS

Female dogs of different breeds viz Labrador retriever, Spitz, Basset hound, Rottweiler, Lhasapso, Dachshund, Pomeranian breeds with clinical signs suggestive of pyometra presented to the University Veterinary Hospitals, Kokkalai and Mannuthy were utilized for the study. Detailed history, clinico- gynaecological examination and clinical parameters were recorded. Confirmation of pyometra was done sonographically using a 5 to 7.5 MHz trans-abdominal probe (MyLab™ 70VETXV[1]). Two dimensional ultrasonographic imaging of uterus was carried out to assess the maximum uterine horn diameter and uterine wall thickness. The cross- sectional image of the uterine horn was frozen and outer uterine horn diameter with widest circular cross sectional diameter and wall thickness of uterine horns immediately after body bifurcation were measured (Batista *et al.,* 2016). Pyometra confirmed bitches were classified into open (Gr. I, n = 6) and closed (Gr. II, n = 6) depending on the clinical signs. A group of six healthy dogs in diestrous phase included as control (Gr. III).

Blood samples were collected from the cephalic vein in to two parts. A volume of 2 mL whole blood was collected into EDTA vacutainer tubes and processed for haematology within 3 to 4 h of collection. Total erythrocyte count (TEC, $\times 10^6$/ $mm^3$), total leucocyte count (TLC, $\times 10^3/mm^3$), thrombocyte count ($\times 10^3/mm^3$), packed cell volume (PCV %) and haemoglobin concentration (Hb, g/ dL) were assessed using automatic haematology analyser (Mythic 18 Vet, Woodley, Switzerland). Blood smears were prepared and differential leukocyte count (DLC) was assessed. Another 5 mL whole blood sample was collected into vacutainer with clot activator for separation of serum. Serum samples were stored at -20˚C for biochemical analysis. Blood urea nitrogen and serum creatinine concentrations were analysed using semi-automatic analyser (Master T biochemistry analyser, Hospitex diagnostics, Italy). The arithmetical mean and standard error were calculated for all parameters using SPSS version 24 by one way ANOVA method.

## RESULTS AND DISCUSSION Haemato-biochemical parameters

Mean TEC was not significantly different between open and closed pyometra but lesser than

that of normal dioestrous bitches. Lower TEC values were previously reported in pyometra affected dogs (Chinnu, 2016; Samantha *et al.*, 2018; and Unnikrishnan, 2018). Mean TEC was lowest in the closed pyometra when compared to open pyometra and normal dioestrous bitches. Similarly, mean haemoglobin (Hb, g/dL) concentration was lower in pyometra affected dogs than physiological levels. The mean Hb concentration in gr. I and II was significantly lower from the gr. III. Similarly, a lower Hb levels was reported in pyometra affected dogs (Gandotra *et al*. 1994; and Kochhar *et al*., 1996).

Mean PCV (%) in both open and closed pyometra was lesser than normal physiological range. In case of closed pyometra, PCV was significantly lower than the normal diestrous bitches suggestive of marked dehydration and anaemia. Kuplulu *et al.* (2009) also observed PCV below 35% in majority of pyometric bitches. Existence of anaemia in both open and closed pyometric bitches was indicated by the lower than normal physiological levels of mean TEC, PCV and Hb values. Normocytic, normochromic anaemia in pyometra was attributed to toxic bone marrow depression with or without loss of red blood cells into the uterine lumen and diapedesis and shortened longevity of circulating red cells due to iron deficiency (Samantha *et al*., 2018; Unnikrishnan,
2018). Also, anaemia of chronic disease can be caused by a variety of disorders including chronic inflammation, in which lactoferrin and other acute phase reactants mediate an iron sequestration within the myeloid cells in the bone marrow, withdrawing iron from the normal erythropoiesis (Nelson and Couto, 1998).

Mean thrombocyte count was relatively lower in the closed cervix pyometra. Marked thrombocytopenia was previously reported in closed cervix pyometra (Shah *et al*., 2017) attributed to adverse effects of endotoxin on bone marrow interfering with platelet synthesis.

Mean TLC in open and closed pyometra was significantly different from the normal diestrous bitches suggestive of leucocytosis. Sevelius (1990) suggested leucocytosis to bone marrow inflammatory response and diffused suppurative inflammation of uterus to combat the infection. Moreover, leucocytosis was more pronounced in closed than open cervix pyometra (Shah *et al*., 2017). Neutrophilia was noticed in closed and open cervix pyometra due to the chemotactic effect exerted by the purulent exudate in the pyometric uterus leading to increased granulocytopoiesis (Ravishankar *et al*., 2004; Shah *et al*., 2017). However, Babu *et al*. (2018) noticed only non-significant neutrophilia among pyometric dogs. In contrary, lymphopenia in the closed cervix pyometra was observed due to immune suppression by endotoxins and bacterial products or due to an absolute neutrophilia, which was supported by Chithra (2013). Prasad *et al*. (2017) also reported that decrease in lymphocyte count directly influenced the severity of disease and recorded more marked lymphopenia in the closed than open cases of pyometra. Mean monocyte and eosinophil counts in the pyometric dogs showed no significant difference between groups.

The biochemical parameters such as BUN and creatinine concentration were analyzed. Mean serum BUN concentration (mg/dL) was significantly higher in gr. I compared to other groups. However, the BUN concentration in closed cervix pyometra was lesser than the normal limits. Similar reports of decreased BUN in pyometric affected dogs was reported previously (Fransson, 2003**)** attributed to polyuria, insufficient protein intake frominappetance or hepatic insufficiency in affected bitches. Mean serum creatinine concentration in closed cervix pyometra was significantly higher than the open cervix pyometra and in non-pyometra dogs, which was in accordance to the earlier study indicating tissue damage, deleterious effect of endotoxin on kidneys and dehydration in closed pyometra (Shah *et al*., 2017).

**Sonographic observations**

In sonographic observations mean uterine horn diameter (mm) in group I and II dogs were 31.49±4.81 and 39.84±3.59, respectively whereas in the normal dioestrus bitch it was 7.13 ±0.34 mm (Table 2, Fig. 1&2). The observations are supported by the earlier findings (Shah *et al*., 2016; Veiga *et al*., 2017; Samantha *et al*., 2018; Unnikrishnan, 2018). Mean uterine wall thickness (mm) in group I and II dogs were 6.24±0.64 and 5.56±1.25 respectively, whereas in normal dioestrus dogs was 1.70±0.05. Bigliardi *et al*. (2004) reported that increase in the uterine wall thickness in pyometra might be due to the hyperplasia of myometrium and endometrium, influenced by progesterone and inflammatory processes. Also, they stated that disproportionate reduction in the size of uterine lumen and glands made the uterus cystic in nature.

**Table 1. Haemato-biochemical parameters (Mean±SE) of pyometra-affected and normal diestrous bitch**

| Parameters | Group I Open cervix pyometra | Group II Closed cervix pyometra | Group III Normal diestrous bitches | Reference range (Slatter, 2003) |
|---|---|---|---|---|
| Total erythrocyte count (TEC, $\times10^6$/mm$^3$) | 4.77±0.48$^{a,b}$ | 3.68±0.54$^{b}$ | 5.86±0.41$^{a}$ | 5.5-8.5 |
| Thrombocyte count ($\times10^3$/mm$^3$) | 236.50±34.55 | 152.50±27.95 | 242.50±51.54 | 200-500 |
| Packed cell volume (PCV, %) | 30.82±2.26$^{a,b}$ | 24.90±2.98$^{b}$ | 37.78±3.84 $^{a}$ | 37-55 |
| Haemoglobin (Hb, g/dL) | 10.38±0.73$^{a}$ | 8.68± 1.07$^{a}$ | 12.43±1.01$^{b}$ | 12-18 |
| Total leucocyte count (TLC, $\times10^3$/mm$^3$) | 30.30±6.63$^{a}$ | 47.36±7.63$^{a}$ | 12.13±1.69$^{b}$ | 6-16 |
| Neutrophil (%) | 74.23±3.69 | 81.38±2.92 | 74.35±1.79 | 60-70 |
| Lymphocyte (%) | 17.81±2.46$^{a}$ | 11.35±1.75$^{a}$ | 17.65±1.24$^{a}$ | 12-30 |
| Monocyte (%) | 6.93±1.32 | 8.13±1.30 | 6.95±0.93 | 3-10 |
| Eosinophil (%) | 2.13±0.44 | 2.09± 0.24 | 1.98±0.45 | 2-10 |
| BUN (mg/dL ) | 20.96±3.79$^{a}$ | 7.38±1.79$^{b}$ | 4.41±1.09$^{b}$ | 15-25 |
| Creatinine (mg/dL ) | 1.60±0.21$^{a,b}$ | 2.12±0.40$^{a}$ | 1.04±0.04$^{b}$ | 0.5 to 1.4 |

a,b:*Means with different superscript differ significantly at 5% level (P <0.05)*

**Table 2:** Uterine horn diameter and uterine wall thickness of pyometra-affected and diestrous dogs (Mean± SE)

| Parameters | Open pyometra | Closed pyometra | Dioestrus bitches |
|---|---|---|---|
| Uterine horn diameter(mm) | 31.49±4.81$^{a}$ | 39.84± 3.59$^{a}$ | 7.13 ±0.34$^{b}$ |
| Uterine wall thickness(mm) | 6.24±0.64$^{a}$ | 5.56 ±1.25$^{a}$ | 1.70±0.05$^{b}$ |

a,b:*Means with different superscript differ significantly at 5% level (P <0.05)*

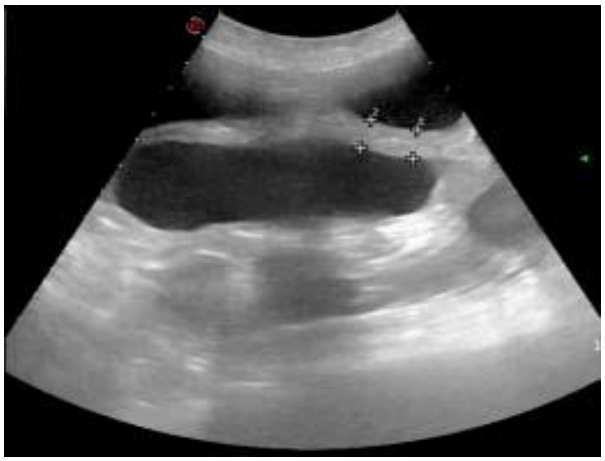

**Fig 1:** Open cervix pyometra with anechoic sacculation

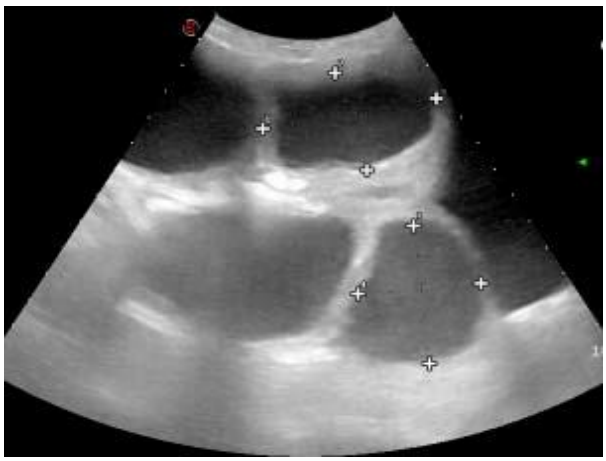

**Fig. 2:** Uterine horn sacculations in closed pyometra

In closed-cervix pyometra, uterine wall thinning was reported (Enginler *et al*., 2014 and Samantha *et al*., 2018), which was contrary to the observations in this study as no significant difference could be observed between open and closed cases. Samantha *et al*. (2018) reported that in closed cervix pyometra bitches, uterine wall was variable in appearance, from thick and irregular to thin and smooth.

## CONCLUSION

Analysis of haemato-biochemical parameters and ultrasonographic examination are useful in confirmatory diagnosis of pyometra. Assessment of uterine horn diameter and echogenicity of the uterine contents suggests the associated cystic endometrial hyperplasia in the pyometra bitch. In addition, the haemato-biochemical parameters in closed cervix pyometra indicate the severity of the inflammatory condition in the uterus and thus monitoring of these parameters will be valuable for monitoring of treatment in dogs with pyometra.

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