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Clinico-pathological Alterations of Pyometra in Cat

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ABSTRACT

Background: Pyometra is an infectious condition characterized by a pus-filled uterus, which basically developed due to hormonal, anatomical and physiological changes and the inside environment of the queen uterus help to grow the opportunistic pathogen. The aim of the present study was made to assess the haemato-biochemical changes of pyometra in infected queens.

Methods: The study was carried out in 12 clinical cases of cat with a history of lethargy, depression, inappetence, polydipsia, occasional vomition and vaginal discharge, presented for treatment at Teaching Veterinary Clinical Complex, College of Veterinary Sciences and A.H., Central Agricultural University, Aizawl, Mizoram. The presumptive clinical diagnosis of pyometra was made based on history, clinical signs and imaging techniques. The involvement of the pathogen was further confirmed by microbial examination of the pus-filled uterus after the ovariohysterectomy.

Result: The study revealed alterations in the total erythrocyte count, haemoglobin and packed cell volume in pyometra cases. The leucogram revealed leucocytosis, neutrophilia and lymphopenia. Biochemical analysis revealed hyperprotenemia, increased liver enzymes and BUN and creatinine. The major pathogens involved in pyometra infected queens are *Escherichia coli*, *Staphylococcus, Streptococcus, Pseudomonas, Proteus* and *Pasteurella.* The analysis of various parameters indicated that haemato-biochemical analysis may be good prognostic markers for feline pyometra.

Key words: Feline pyometra, Haemato-biochemical alteration, Ultrasound.

INTRODUCTION

Pyometra is an infectious condition characterized by a pus-filled uterus, basically developed due to hormonal, anatomical and physiological changes and the inside environment of the uterus help to grow the opportunistic pathogen, ensuing in a potentially fatal infection that occurs when a cat has a heat cycle and there may be devoid of pregnancy. The disease is most often observed in diestrus or 'pseudo-pregnancy' in the queen, which is a phase of progesterone dominance that lasts approximately 40 days. The relatively long progesterone-dominated diestrus phase occurs in queens that undergo ovulation (induced or spontaneous) and predisposes them to the development of pyometra caused by infection from bacteria ascending from the vagina. The pathogenesis of pyometra is incompletely understood, but it is considered that the hormonal influence of progesterone during its cyclic luteal phase leads to proliferation of the endometrium, stimulation of endometrial glands secretions, suppression of myometrial contractions, closure of cervix and negative effects on uterine immunity while protecting against infections (Sant'Anna *et al*., 2014). In the majority of cases, *Escherichia coli* is the main organism causing pyometra (Hollinshead and Krekeler, 2016). Analogous to the female dog, despite the underlying cause, the presence of progesterone in the circulation facilitates the development of pyometra (Hollinshead and Krekeler, 2016; Haji *et al*., 2018). The occurrence of pyometra in cats is lower in comparison to female dogs, as cats are induced ovulators. However, underestimation of disease incidence is likely because queens often do not express clinical signs to the same extent as seen in bitches (Verstegen and Onclin, 2006).

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There has been modest publication to date on feline pyometra and most of the obtainable information has been generated from studies carried out in female dogs. Therefore, this study has been carried out to know the clinico-pathological changes in feline pyometra.

MATERIALS AND METHODS

The study was carried out in 12 clinical cases of cat with a history of lethargy, depression, inappetence, polydipsia, occasional vomition and vaginal discharge, presented for treatment at Teaching Veterinary Clinical Complex, College of Veterinary Sciences and A.H., Central Agricultural University, Aizawl, Mizoram. Further, six healthy non-pregnant cats presented for routine ovariohysterectomy were considered for comparison of haemato-biochemical attributes. The presumptive clinical diagnosis was based on case history, clinical signs and ultrasonography (Esaotemylab 40, Italy) or

radiography, or both. The diagnosis was confirmed by macroscopic examination of a pus-filled uterus during and after the ovariohysterectomy. B-mode ultrasonography was performed to visualize the uterus using the Esaotemy lab 40 model with the trans-abdominal (convex) probe at 5.0 MHz and the uterine horn diameter was measured using the machine's inbuilt digital calliper.

After retrieval of history and ultrasonographic evaluation, 5 ml of blood was collected from each affected and healthy animals. About 1 ml of blood was poured into a sterile vial containing anticoagulant EDTA (2 mg/ml) for haematological studies. The remaining blood was collected in a test tube and was allowed for clotting, serum was separated by centrifugation and supernatant was then collected in sterile vials. The haematological parameters were determined using an automated blood counter (MS4E, French). The levels of blood urea nitrogen (BUN), creatinine, aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (ALP) and total protein were determined by commercially available assay kits with the help of a biochemical analyzer (Fuji Dry Chem NX500 Analyzer, Clinical Chemistry analyzer, India).

After ovario-hysterectomy, the contents of uterus were aseptically aspirated by a sterile syringe. Then the samples were sent to the microbiology laboratory. The cultures were grown on 5% sheep blood agar (Himedia®, Mumbai, India), and the plates were incubated aerobically at 37°C for 72 hours. The isolated microorganisms were analyzed by Gram staining, catalase, coagulase and esculin tests and 6.5% NaCl tolerance (Holt *et al*., 1994). Gram negative bacteria were placed on MacConkey agar and identified by the Bactray system (Laborclin® Pinhais, Brazil).

The study was duly approved by the Institution Animal Ethics Committee, College of Veterinary Sciences and A.H., Central Agricultural University, Aizawl, Mizoram, India.

The data obtained from individual queens subjected to statistical analysis by using SPSS software version 16.0 and presented as mean±standard error (SE). The haemato-biochemical parameters of pyometra affected and healthy queens were compared by using paired t-test.

RESULTS AND DISCUSSION

Diagnosis of pyometra by imaging techniques

Feline pyometra is considered a potential medical emergency, though it is often difficult to diagnose, as there may be mild clinical signs and laboratory changes (Klainbart *et al*., 2017). Consequently, the disease could have been progressing for a longer time when being diagnosed, which may lead to a more severe illness (Jitpean *et al*., 2017). Pyometra can be diagnosed based on case history, clinical examination, and laboratory analyses, often combined with radiography and/or ultrasonography of the uterus and ovaries (Hauptmann *et al.,* 1997, Haji *et al*., 2017). All twelve cases were confirmed as pyometra by imaging techniques. The radiographic projections in most cases at lateral recumbency revealed that there was a craniodorsal displacement of the small bowel and a twisted uniform tubular opacity in the caudo-ventral abdomen. There was a cranial and medial displacement of the small bowel when the animal was in the ventro-dorsal position. The uterus was largely distended. The abdominal ultrasonographic examination revealed the distention of the uterus with an anechoic to hyperechoic fluid (Fig 1). The findings during clinical examination depend upon the patency of the cervix. In open-cervix pyometra, the most important finding is the presence of foul-smelling, sanguineous, mucopurulent discharge (Feldman and Nelson, 2004). The brown chocolate malodorous vaginal discharge observed in 58.33% of cats suspected of pyometra in the present study. Systemic signs such as depression, listlessness, lethargy, anorexia, vomiting and weight loss also observed by Feldman and Nelson (2004). Affected queens are dehydrated and hyperthermic. Hyperthermia is supposed to be associated with uterine inflammation and secondary bacterial infection as well as septicaemia or bacteraemia (Fransson and Ragle, 2003). Radiology of the abdomen can confirm the uterine enlargement: the x-rays identified a uterus that emerges from the pelvis as dilated, showed a homogeneous and sacculiform structure with the dorsal and cranial displacement of the small intestine. The radiography

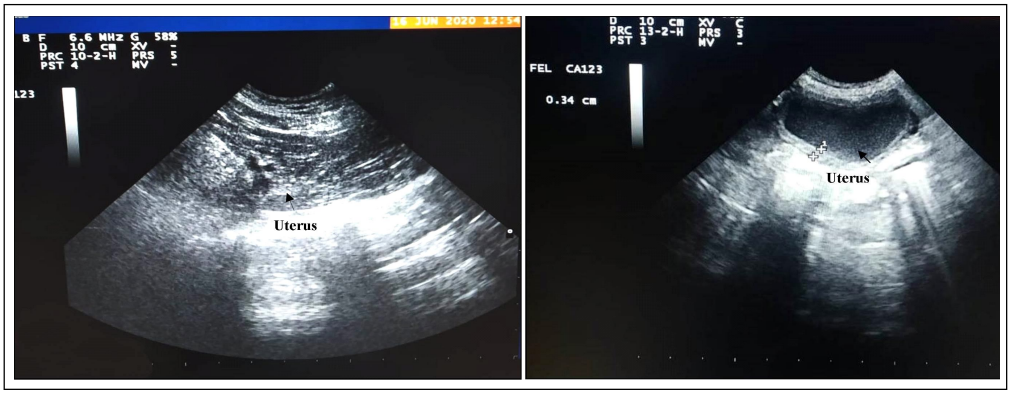

Fig 1: Abdominal ultrasonographic examination revealed the distension of the feline uterus.

can be used as an aid in diagnosing pyometra in the queen, but generally is inconclusive. This is due to similar radiographic characteristics of mucometra and uterine torsion with pyometra (Shull *et al*. 1978). For diagnosis of pyometra in companion animals, ultrasonography is one of the most imperative tools (Davidson and Baker, 2009; Hollinshead and Krekeler, 2016). In the early hours in the disease progression, the uterine horns classically emerge distended with hypoechoic to hyperechoic fluid, with or without flocculation. The uterine wall might be thickened with irregular boundaries and small hypoechoic areas steady with cystic proliferation of endometrial glands. The amount of uterine pus depends on the patency of cervical lumen. In close cervix pyometra, there is a larger amount of uterine pus present in the lumen. A similar observation was also reported by Lee *et al*. (2016) in canine pyometra.

Microbial species isolated from the uterus of queens with pyometra

The major pathogens isolated from the pyometra uteri of the queen in this study were *Escherichia coli, Staphylococcus, Streptococcus, Pseudomonas, Proteus* and *Pasteurella*. The coliform bacteria *i.e. Escherichia coli* was the leading pathogen (41.66%), other than that other species (Fig 2). In this study, the main bacteria isolated were *E Coli*, *Staphylococcus aureus*, *Proteus* species and *Streptococcus* species. Weiss *et al*. (2004) and Emanuelli *et al.* (2012) found similar diversity about the etiological agents of pyometra. The uterus is presumed to become infected via an ascent of faecal bacteria through the vagina during oestrus when the cervix is relaxed (Wadas *et al*., 1996). It has been shown that *E. coli* are capable of establishing an infection in young queens. Apart from bacterial virulence, other factors are also associated with the occurrence of pyometra in the queen, such as inadequate innate immune response and hereditary predisposition (Ruthrauff *et al*., 2009).

Clinico-pathological changes

All the pyometra infected queens showed various clinical signs which help for diagnosis of pyometra. Major clinical signs observed in pyometra infected queen were lethargy/ depression (100%, 12/12), anorexia (100%, 12/12), brown chocolate malodorous vaginal discharge vaginal discharge (58.33%, 7/12), polydipsia (41.66%, 5/12), abnormal mucous membranes (75.0%, 9/12), uterine distension (100%, 12/ 12), polyuria (50.0% 6/12), vomition (16.66%, 2/12), fever (66.66%, 8/12) and dehydration (75.0%, 9/12) (Fig 3).

The physical parameters *viz*. rectal temperature, heart rate, pulse rate and respiration rate of pyometra affected

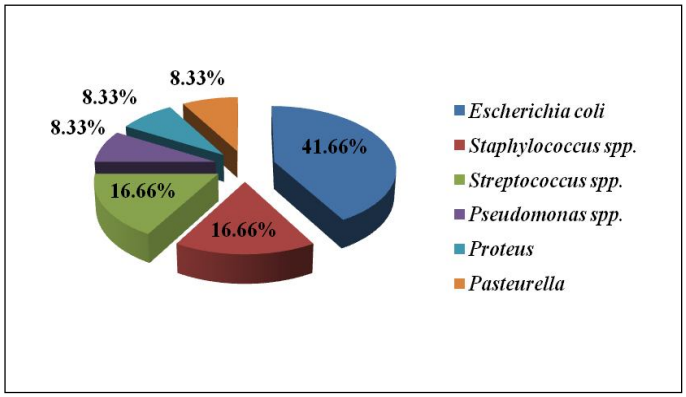

Fig 2: Major pathogens isolated from the uterus of queens with pyometra.

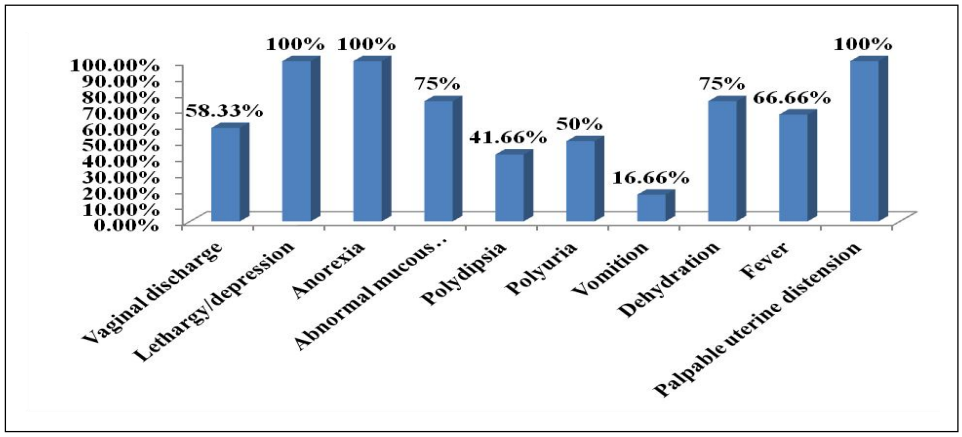

Fig 3: Major clinical signs observed in pyometra infected queen.

queens were significantly (P<0.01) higher (102.70±0.23°F, 140.62±2.41 beats/min, 144.54±2.8 beats/min and 38.58±1.45 per min, respectively) in comparison to healthy queens (100.10±0.24°F, 121.08±2.32 beats/min, 120.58±2.47 beats/min and 27.25±1.20 per min, respectively) (Fig 4).

The haematological parameters *viz.* Hb, PCV, RBC were significantly (P<0.01) decreased in pyometric queen in comparison to healthy which indicated anaemia (Table 1). The DLC analysis revealed neutrophilia, lymphocytosis with eosinophilia in the pyometra affected queen (Table 1) as compared to healthy. There were no significant differences in red cell indices between infected and healthy ones.

Biochemical parameters *viz.* total protein, BUN, creatinine, ALP, ALT and AST were significantly (P<0.01) increased in pyometra infected queens as compared to healthy (Table 1).

These results indicate that queens with closed cervix pyometra are in a more serious state than those with open

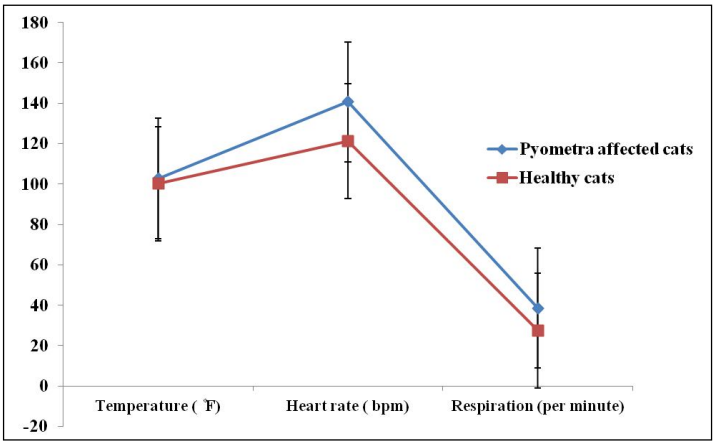

Fig 4: Physical parameters rectal temperature, heart rate and respiration rate of pyometra affected queens.

Table 1: Level of haemato-biochemical parameters of pyometra affected and healthy cats (mean±SE).

Parameters	Pyometra affected cats (n=12)	Healthy cats (n=6)	t-value
Temperature (F)	102.70±0.23	100.10±0.24	9.330**
Heart rate (bpm)	140.62±2.41	121.08±2.32	7.918**
Respiration (per minute)	38.58±1.45	27.25±1.20	6.175**
Haemoglobin (gm/dl)	8.16±0.40	11.54±0.34	6.360**
RBC(×10^6 / µL)	6.37±0.35	7.60±0.43	3.600**
PCV (%)	21.70±0.96	30.70±1.18	6.917**
TLC(x 1000/µL)	165.12±8.97	121.00±5.98	5.343**
Nutrophil (%)	88.25±2.78	50.33±3.73	12.390**
Lymphocyte (%)	57.29±4.00	38.00±1.92	4.511**
Monocyte (%)	6.87±0.34	4.47±0.48	5.701**
Eosinophil (%)	2.86±0.36	1.90±0.24	3.763**
Basophil	Nil		
MCV (fL)	54.50±2.00	53.12±1.60	0.582^{NS}
MCH (pg)	14.58±0.88	19.95±0.47	5.731**
MCHC (%)	23.12±1.11	29.91±0.37	5.422**
BUN (mg/dl)	68.25±6.39	28.12±2.01	7.175**
Creatinine (mg/dl)	2.40±0.29	1.68±0.22	5.532**
AST (IU/L)	39.95±3.35	23.00±2.08	6.210**
ALT (IU/L)	57.91±7.55	45.04±6.03	3.838**
ALP (IU/L)	89.95±4.71	46.79±4.36	8.948**
Total protein (g/dl)	9.56±0.67	7.41±0.30	3.260**

** Significant at P<0.01; ^{NS} Non significant.

cervix pyometra. Therefore, these patients must undergo haematological and blood biochemical examination, as the queens with pyometra may have liver damage, dehydration and electrolyte imbalance. Queens with pyometra showed various abnormalities of haematological and biochemical variables. In the present study, abnormal patterns of blood profiles were similar to previous studies (Kaymaz *et al*., 1999). The anaemia in affected queens can be attributed to toxic depression of bone marrow and or loss of red cells into the uterine lumen. Another possible explanation is that along with the diapedesis of erythrocytes into the uterine lumen, a shortened life span of circulating erythrocytes due to iron deficiency may also be responsible for the anaemia (Samantha *et al*., 2018). Leucocytosis has been considered as a classical sign of pyometra in the queen in this study which has been recorded by several authors (Hagman *et al.,* 2009). The noticeable leucocytosis observed in the present study might be due to bone marrow inflammatory response (Sevelius, 1990) and diffused supportive inflammation of the uterine lumen to battle the infection. The neutrophilia recorded in the present investigation may be attributed to the defence mechanism of the uterus in response to the invading microorganisms. Increased concentrations of BUN and creatinine were common complications of pyometra, and they may be also caused by dehydration associated with anorexia and vomiting (Hagman *et al.,* 2014). Chojong and Kimhyesod (2000) and Sharma (2004) have also reported high serum creatinine concentration in dogs with pyometra. The increased activity of AST, ALT and ALP indicated that toxaemia originating from pyometra may inhibit the synthesis of liver enzymes and damage the hepatic membrane (Bigliardi *et al.,* 2004).

These results indicate that queens with closed cervix pyometra are in a more serious state than those with open cervix pyometra. Therefore, these patients must undergo immediate diagnosis by ultrasonographic as well as haematological and blood biochemical examination. The analysis of various parameters helps in the assessment of the clinical status of the queens and the prediction of the prognosis.

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Conflict of interest: None.

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