



Ultrasonographic detection of cystic endometrial hyperplasia and pseudoplacental endometrial hyperplasia in pyometra-affected bitches

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Abstract

This study evaluated the occurrence of cystic endometrial hyperplasia (CEH) and pseudoplacental endometrial hyperplasia (PEH) in canine pyometra using ultrasonographic assessment of endometrial changes. Fifty bitches with clinical signs of pyometra were diagnosed based on clinical, haematological, and B-mode and Doppler ultrasonographic findings. Systemic inflammatory response syndrome was present in 47 cases. Ultrasonography revealed marked uterine distension (2.58 ± 0.19 cm), increased uterine wall thickness (3.97 ± 0.27 mm), and reduced uterine arterial resistance (RI 0.64 ± 0.01). Ultrasonographically, CEH was detected in 92 per cent of cases, while 8 per cent showed no evidence of CEH or PEH. CEH grading included 2 Grade A, 17 Grade B, 21 Grade C, and 6 Grade D cases, with variable echogenicity of uterine contents. No ultrasonographic features characteristic of PEH were identified in pyometra-affected bitches. These findings indicate that CEH was the predominant, ultrasonographically detectable endometrial lesion associated with canine pyometra, whereas PEH was not identified in pyometra affected patients using ultrasonographic criteria.

Keywords: Cystic endometrial hyperplasia; Canine; Pseudoplacental endometrial hyperplasia; Pyometra

Bitches in dioestrus are characterised by prolonged exposure to elevated progesterone concentrations. This physiological feature predisposes the uterus to pathological changes such as cystic endometrial hyperplasia (CEH), pseudoplacental endometrial hyperplasia (PEH) and pyometra, although the precise pathogenesis remains incompletely understood. Pyometra is a potentially life-threatening uterine infection and inflammation; CEH represents abnormal endometrial growth and repair characterised by excessive glandular proliferation and cyst formation, and PEH has been described as a reactive endometrial change resembling placentation that can occur in response to embryos, foreign bodies or infectious agents (Nomura, 1994).

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The classical concept of a CEH–pyometra complex proposed by Dow (1959b) posited a causal relationship between endometrial hyperplasia and uterine infection. In contrast, De Bosschere *et al.* (2001) suggested that CEH and pyometra are distinct entities that can occur independently. More recently, Santana *et al.* (2020) reported a significant association between PEH and pyometra, challenging earlier concepts of disease pathogenesis. Ultrasonographically, PEH has been described as circumferential endometrial thickening with organised hyperechoic linear striations oriented perpendicular to the uterine lumen (Ma *et al.*, 2021). However, most reports linking PEH to pyometra are based on histopathological observations, and information on its ultrasonographic detectability in naturally occurring clinical cases remains limited. The present study, therefore, aimed to evaluate the occurrence of CEH and PEH in ultrasonographically graded cases of canine pyometra.

Materials and methods

Study population

The study was conducted in fifty bitches presented at the Teaching Veterinary Clinical Complex, Mannuthy, and the University Veterinary Hospital, Korkkai, between August 2024 and December 2025 with clinical signs suggestive of pyometra. The diagnosis was based on clinical examination, haematological findings and ultrasonographic evaluation. The pyometra-affected bitches were subsequently managed medically or surgically following the patient's status and the owners' consent.

Clinical and haematological assessment

Clinical evaluation included recording of vital parameters, hydration status and the presence and nature of vaginal discharge. Haematological analysis was performed using an ORPHEE Mythic 18 Vet CBC analyser to determine total leukocyte count ($\times 10^3/\mu\text{L}$) and band neutrophil percentage, while systemic inflammatory response syndrome status was assessed to evaluate the extent of systemic involvement.

Ultrasonographic evaluation and grading

Transabdominal B-mode and Doppler ultrasonography were performed using MyLab X8 eXP Vet and MyLab Sigma VET ultrasound units (Esaote) with curvilinear (1–8 MHz), linear (4–15 MHz) and micro-convex probes (3–11 MHz). Animals were examined in dorsal recumbency following standard preparation. Measurements included maximum uterine horn diameter, uterine wall thickness, endometrial morphology and echogenicity of uterine contents. Further, uterine contents were categorised as anechoic, hypoechoic or hyperechoic and ultrasonographic evidence of CEH and PEH was recorded as described by Bigliardi *et al.* (2004) and Ma

et al. (2021), respectively. Uterine changes were graded into four categories (Groups A–D) based on endometrial morphology and cystic changes. However, ultrasound identification of PEH was limited in the present study.

Results and discussion

In pyometra-affected bitches, marked leukocytosis, neutrophilia and elevated band neutrophil counts were consistently observed, reflecting severe systemic inflammation and infection. The haematological evaluation of bitches affected with pyometra revealed marked alterations consistent with systemic inflammation and infection. The mean total leukocyte count was $37.42 \pm 3.39 \times 10^3/\mu\text{L}$, with 46 out of 50 animals exhibiting leukocytosis, indicating a strong inflammatory response. Neutrophil percentage was markedly elevated ($82.30 \pm 0.96\%$), with 48 animals showing neutrophilia, reflecting an active bacterial infection and acute inflammatory process. Similar haematological alterations have been widely reported by Krishnan *et al.* (2023) and Demeli and Meyer (2023). In the present study, 47 of 50 bitches were SIRS-positive, which describes a strong association between pyometra and SIRS, particularly in cases complicated by sepsis and circulatory shock (Singh *et al.*, 2020). Stress-related physiological responses during clinical presentation and handling may have influenced some SIRS parameters, particularly heart and respiratory rates (Peixoto *et al.*, 2023; Thilak, 2024).

Ultrasonographic evaluation revealed significant uterine distension and increased uterine wall thickness compared with healthy dioestrous bitches, findings that are consistent with previous reports of pyometra (Bigliardi

Table 1. Ultrasonographic findings (Mean $\pm$ SE) of uterus in bitches affected with pyometra (n = 50)

Ultrasonographic parameter	Recorded values
Uterine diameter (cm)	2.58 ± 0.19
Uterine wall thickness (mm)	3.97 ± 0.27
Pulsatility index	1.39 ± 0.08
Resistivity index	0.64 ± 0.01
Echogenicity of uterine contents	
Anechoic	19
Hypoechoic	27
Hyperechoic	4
Ultrasonographic features suggestive of CEH concurrent to pyometra	46
Grade A	2
Grade B	17
Grade C	21
Grade D	6
Ultrasonographic features suggestive of PEH	0
Ultrasonographic features suggestive of pyometra alone	4

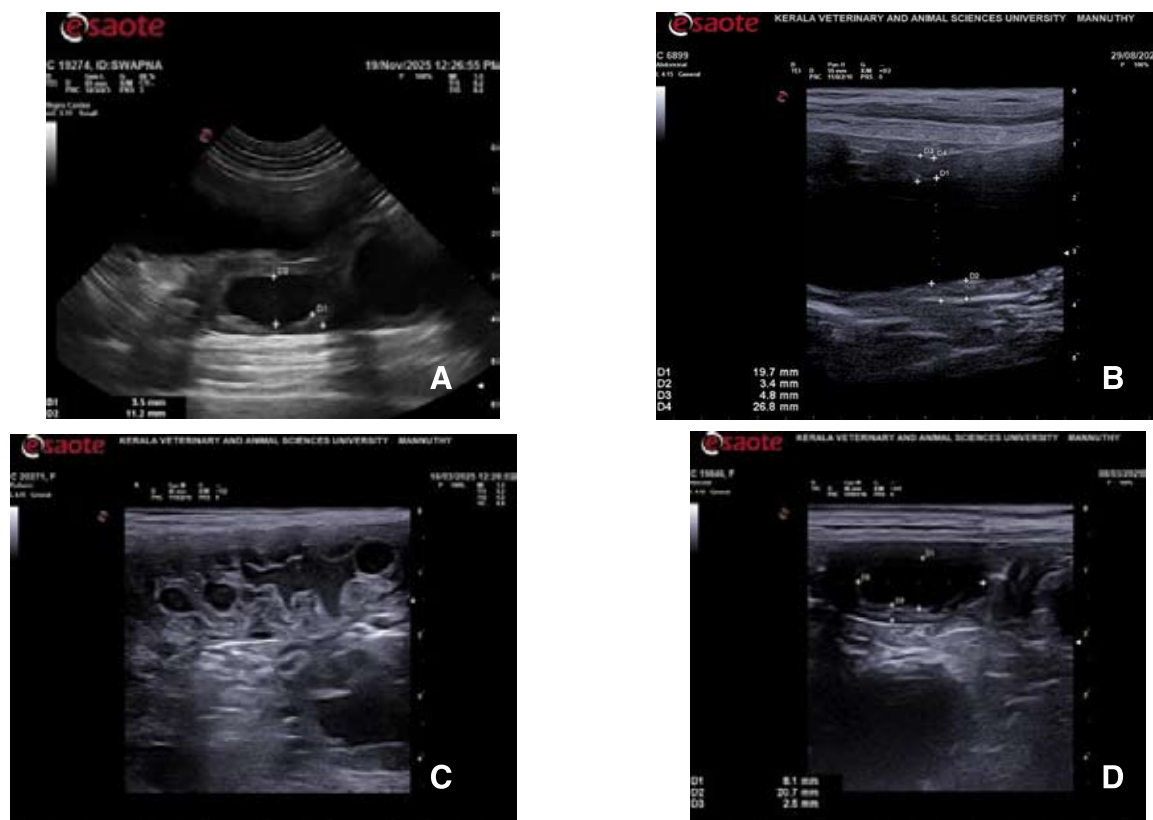


Fig. 1. B- mode ultrasound image of uterus in pyometra affected bitches revealing Grade A (A), Grade B (B), Grade C (C) and Grade D (D) cystic endometrial hyperplasia

et al., 2004; Veiga et al., 2017; Unnikrishnan *et al.*, 2020). In this study, hypoechoic uterine contents predominated, reflecting purulent material of variable cellularity. Cystic endometrial hyperplasia was detected ultrasonographically in 92 per cent of cases, with advanced grades (B and C) predominating, indicating a strong association between progressive endometrial hyperplasia and pyometra (Table 1, Fig 1). Bitches with grade C or D changes usually have limited response to medical management (Bigliardi et al., 2004; Harshan et al., 2022, Ram et al., 2024). Doppler ultrasound evaluation revealed reduced uterine arterial resistance (less than 0.72) in each and every case and a mean of 0.64 ± 0.01 , consistent with inflammatory hyperaemia and altered haemodynamics reported in earlier studies (Konjeti et al., 2022). Batista et al. (2016) reported that RI values below 0.72 were associated with pyometra, whereas values exceeding 0.72 were observed in cases of CEH without pyometra.

Ma et al. (2021) described a distinctive B-mode ultrasonographic pattern of pseudoplacental endometrial hyperplasia, characterised by multiple organised hyperechoic linear striations perpendicular to the mucosal surface, indicating marked endometrial thickening. No ultrasonographic features consistent with pseudoplacental endometrial hyperplasia were identified in pyometra-affected bitches. However, a single case of a uterine lesion similar to PEH was noted in a young bitch presented for pregnancy diagnosis (Fig. 2).

As the owner did not consent to OHE, histopathological confirmation could not be performed. While this finding suggests that PEH is not commonly detectable ultrasonographically in clinical cases of pyometra, the possibility of subclinical or histologically detectable PEH that does not meet ultrasonographic criteria cannot be excluded.

The observations of the present study were in sharp contrast to those of Santana et al. (2020), who reported



Fig. 2. Ultrasonography of apparent pseudoplacental endometrial hyperplasia recorded during routine pregnancy diagnosis in a bitch revealing thickened endometrium with multiple organized hyperechoic linear striations, perpendicular to the mucosal surface

an overwhelming association of PEH with pyometra (79.4%) compared to CEH with pyometra (20.6%) among dogs in Brazil. This difference in observations could reflect strict breeding practices and the routine implementation of OHE in dogs not intended for breeding in Brazil. CEH is generally associated with older dogs with repeated non-pregnant cycles and plays a crucial role in its development. Notably, the single incidental finding of PEH occurred in a young bitch.

Conclusion

Cystic endometrial hyperplasia was the predominant, ultrasonographically detectable endometrial lesion associated with canine pyometra in the present study. A small proportion of bitches developed pyometra without concurrent ultrasonographic evidence of endometrial hyperplasia. Pseudoplacental endometrial hyperplasia could not be identified using ultrasonographic criteria in affected bitches, suggesting limited detectability in clinical imaging or limited association with pyometra. Further studies with systematic histopathological correlation are warranted to clarify the role of PEH in the pathogenesis of canine pyometra.

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Conflict of interest

The authors declare that they have no conflict of interest.

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