



Evaluation of the effectiveness of surgical treatment using sonographic diagnostics with pyometra in dogs

Ihor Dekhnych*

Postgraduate Student

Poltava State Agrarian University

36003, 1/3 H. Skovoroda Str., Poltava, Ukraine

<https://orcid.org/0000-0001-5687-3765>

Abstract. The relevance of this study lies in the necessity to evaluate the effectiveness of surgical treatment for pyometra in dogs, employing sonographic diagnosis. Pyometra, a common uterine infection in female dogs, can lead to life-threatening complications such as sepsis and kidney damage if left untreated. Ultrasound imaging, a non-invasive and effective diagnostic tool, plays a crucial role in the early detection of pyometra and can identify potential post-operative complications following ovariohysterectomy. This study aimed to identify the ultrasound characteristics of the abdominal cavity in dogs affected by pyometra and to compare the postoperative ultrasound features of the abdominal cavity following ovariohysterectomy over time in a group of animals with and without complications. The primary research method involved a sequential and targeted ultrasound examination of the abdominal cavity in dogs diagnosed with pyometra. Subsequent ultrasound examinations were performed during ovariohysterectomy and at 1, 5, and 10 days postoperatively. It was established that the pathologically altered uterus on ultrasound often exhibited characteristics of an enlarged, distended tubular structure with anechoic or hypoechoic content. Ultrasound examination of affected dogs also demonstrated diagnostic effectiveness in cases of visualising intrauterine fluid, even when the uterine size was within normal limits. The use of ultrasound diagnostics allowed for the timely detection of pyometra at early stages, significantly improving the effectiveness of subsequent treatment. Ovariohysterectomy proved to be the most effective treatment method for dogs with pyometra, promoting the normalisation of vital functions as early as 2-3 days post-surgery, which reduced the risk of recurrence. Dynamic ultrasound examination of the abdominal cavity after surgery ensured timely adjustment of treatment measures and improved prognosis for patients. The established facts have practical

Suggested Citation:

Dekhnych, I. (2024). Evaluation of the effectiveness of surgical treatment using sonographic diagnostics with pyometra in dogs. *Ukrainian Journal of Veterinary Sciences*, 15(3), 76-93. doi: 10.31548/veterinary3.2024.76.

*Corresponding author



significance for veterinarians, which will contribute to improving the quality of pyometra diagnosis in dogs, the effectiveness of their treatment, and reducing mortality

Keywords: uterine pathology; ultrasound diagnosis; surgical intervention; postoperative period; intrauterine fluid; complications

Introduction

Pyometra is a common condition in adult female dogs, caused by an acute or chronic bacterial infection of the uterus. This pathology is characterised by the accumulation of inflammatory exudate within the uterine cavity and presents with various clinical signs. Pyometra most commonly occurs in females during the luteal phase of the cycle due to high levels of progesterone, which plays a key role in its development. The diagnosis is based on medical history, physical examination, laboratory tests, and results from radiography and/or ultrasound, which reveal an enlarged, fluid-filled uterus. Delayed diagnosis of pyometra, when the kidneys are already damaged, can lead to irreversible consequences for their function.

B. Gasser *et al.* (2020) demonstrated the potential for multiple organ dysfunction as a consequence of sepsis and endotoxemia, which can be life-threatening. This research highlighted the importance of early diagnosis of pyometra to prevent serious complications. In this context, ultrasound imaging emerges as an accurate method for diagnosing pyometra in dogs. Pathological changes in the uterus, such as endometrial hyperplasia, can lead to infertility in dogs. These conditions may be collectively referred to as “pyometra” or considered as a symptom complex of endometritis with the accumulation of purulent exudate in the uterine cavity. Pyometra in dogs remains one of the most common and serious reproductive pathologies. In recent years, numerous studies have been dedicated to improving diagnostic and treatment methods for this disease.

Scientists have investigated clinical and ultrasound indicators for the early diagnosis of septic acute kidney injury in female dogs with pyometra, underscoring the importance of timely diagnosis.

S. Ahn *et al.* (2021) compared clinical and inflammatory parameters in dogs with pyometra before and after ovariectomy, emphasising the importance of surgical intervention. Their research highlighted that surgery is the key treatment for pyometra, contributing to the normalisation of vital functions in dogs as early as 2-3 days postoperatively. P.R. Batista *et al.* (2022) evaluated the use of Doppler ultrasonography to assess females receiving medical treatment for pyometra, emphasising the effectiveness of this method. Doppler ultrasonography allowed for the detection of changes in uterine blood flow, which is an important indicator for determining the animal’s condition and treatment effectiveness.

Ukrainian researchers have also made significant contributions to the study of pyometra. P.M. Sklyarov & V.V. Piatibrat (2021) reviewed the diagnostic aspects of pyometra in female dogs, providing an overview of current information on this topic. Their study includes a detailed analysis of diagnostic methods used in Ukraine and their comparison with international standards. D.V. Zarutskya (2022) investigated the application of ultrasound for the diagnosis of pyometra in dogs, confirming its high diagnostic value. Her research highlighted that ultrasound diagnostics allows for the timely detection of pathological changes in the uterus

and the presence of intrauterine fluid, even in cases where uterine size is within normal limits. In recent studies, scientists have focused on various aspects of pyometra development. R. Hagman (2022) updated information on pyometra in small animals, including new approaches to diagnosis and treatment. His research showed that a comprehensive approach to the diagnosis and treatment of pyometra can significantly reduce mortality from this disease.

M.K. Nilsson *et al.* (2023) investigated the sonographic features of uncomplicated post-operative abdominal conditions in dogs treated for pyometra via ovariohysterectomy. Their study confirmed that ultrasound imaging is a valuable tool in monitoring the post-operative condition of patients. A.J.R. Peixoto *et al.* (2023) examined the impact of clinical presentation, the presence of systemic inflammatory response syndrome (SIRS), and organ dysfunction on mortality in female dogs with pyometra, highlighting the importance of a comprehensive approach to the treatment of this disease. Their research confirmed that timely diagnosis and adequate treatment significantly increase the chances of a successful recovery.

E. Porowska *et al.* (2018) argued that in the current context of veterinary medicine, it is important to implement new technologies and diagnostic methods that ensure high accuracy and timeliness in disease detection. The development of ultrasound diagnostics opens up new opportunities for veterinarians in diagnosing reproductive pathologies, such as pyometra, allowing for a significant improvement in the quality of treatment. The application of modern diagnostic and treatment methods not only increases the effectiveness of therapy but also reduces the risk of complications and mortality in animals. Thus, the study of the effectiveness of surgical treatment of pyometra using ultrasound diagnostics is a relevant and important area of research. Therefore, pyometra in female

dogs is a serious disease that requires timely diagnosis and adequate treatment. Ultrasound diagnostics emerges as an important tool in the early detection and monitoring of this disease. Surgical treatment, supported by modern diagnostic methods, can significantly increase the chances of a successful recovery.

This study aimed to evaluate the effectiveness of surgical treatment of pyometra in dogs using sonographic diagnosis. The objectives of the study included the analysis of the effectiveness of ultrasound diagnosis in the early detection of pyometra, the assessment of clinical outcomes following surgery, and the comparison of the obtained data with previously described facts in the literature.

Literature Review

Pyometra accounts for over 87% of gynaecological pathologies in dogs. In 80% of cases in female dogs, this condition is caused by false pregnancy, chronic genital inflammation, and functional disorders such as uterine atony and hypotonia (Zarutska, 2022). Pyometra is a potentially life-threatening condition and can have fatal consequences due to toxin poisoning (endotoxemia), the development of peritonitis, and systemic sepsis. P.M. Sklyarov & V.V. Piatibrat (2021) found that in most cases, *Escherichia coli* is often the cause of purulent uterine inflammation.

According to R. Rautela & Katiyar (2019), the disease is not seasonal and can occur due to abnormal sexual cycles, missed matings, pathological births, medication effects, and other factors. Inflammatory processes in the uterus are often accompanied by mastitis, forming the symptom complex “endometritis-mastitis”. V. Sachan *et al.* (2019) established that cats with polycyclic cycles have an increased risk of pyometra. This disease can develop at different ages, even immediately after oestrus during the luteal phase. On average, pyometra is detected

in animals aged 5-6 years, but this pathology is recorded in females from 8 months of age and throughout life (13-16 years). The incidence increases with age, the older the animal, the more likely the pathology. In pyometra, conditions are created in the uterine cavity that adversely affect the survival, movement, and viability of sperm.

The primary cause of endometritis and pyometra is attributed to the influence of infection that enters during oestrus. Depending on the aggressiveness of microorganisms and the resistance of genital tissues, the symptoms of the disease can vary from obvious to hidden. Treating endometritis and pyometra is a complex task. L. Llazani *et al.* (2021) demonstrated that pyometra in dogs is one of the most common reproductive disorders found in female dogs, especially during dioestrus and the dominant progesterone phase of the oestrus cycle. This is an accumulation of exudate in the uterine lumen, which usually occurs during or after a cycle with high progesterone levels. Symptoms of this disorder include weakness, loss of appetite, increased thirst and urination, vomiting, and abnormal vaginal discharge.

Depending on the nature of the exudate in the uterine cavity, inflammatory processes can be classified as serous, catarrhal, purulent, fibrinous, or haemorrhagic. N.P. Ovcharuk & O.O. Kravchuk (2016) established that pyometra can manifest in either acute or chronic forms, with symptoms that may be clinically apparent or subclinical.

It has been demonstrated that the pathological changes in the uterine tissues are dependent on the type of pathogen and the immune response of the organism. In cases of serous and catarrhal endometrial inflammation, erythema of the swollen mucosa is observed, accompanied by the discharge of serous exudate. Haemorrhages of various types can be visualised within the uterine tissues. Ulcerations form on the surface of the endometrium

following the detachment of necrotic tissues. Changes in the glandular part of the endometrium are characterised by infiltration, dilatation of the glands, thinning between them, filling the cavity with secretion, and the formation of cysts. The walls of the blood vessels undergo thickening, the lumen becomes narrower, and there is evidence of obliteration and calcification (Hagman, 2018).

A.J.R. Peixoto *et al.* (2023) found that pyometra is characterised by the discharge of brown mucus from the vaginal opening with admixtures of exudate. With an open cervical canal, exudate constantly flows out of the body, whereas with a closed canal, the exudate accumulates in the uterine cavity, leading to asymmetry of the uterine horns, their adhesion, and the detection of fluctuation during rectal examination. During oestrus, the exudate discharge increases. During mating, fertilisation does not occur, even with an intact sexual cycle.

With a prolonged course of these diseases, deep morphological changes in the uterine wall occur, leading to infertility in animals. If untreated, pyometra can be fatal. Weakened uterine contractility can be caused by various factors such as lack of exercise, poor nutrition, diseases of other organs, as well as pathological complications of pregnancy, including a large number of foetuses, foetal hydrops, retention of foetal membranes, metritis and endometritis, and the development of ovarian cysts. All of the above factors can eventually lead to pyometra.

In most cases, treatment of any form of pyometra typically involves surgery, as this method is more effective and the risk of recurrence is nearly eliminated (Pailler *et al.*, 2022). Typically, the diagnosis of uterine inflammation includes an analysis of the medical history, clinical manifestations, and the conduct of special examinations such as ultrasound and radiography. M. Woźna-Wysocka *et al.* (2021) determined that timely diagnosis and treatment of

pyometra significantly increase the likelihood of animal survival. The diagnosis of “pyometra” is established taking into account the anamnestic data, clinical symptoms, general examination, results of general and biochemical analysis, and ultrasound of the uterus.

The disease is easily differentiated in typical cases, but in the absence of visible vaginal discharge, diagnosis is difficult, especially if the medical history and clinical symptoms are unclear. As R. Hagman (2022) demonstrated, palpation can detect a distended, segmented uterus, making radiography unnecessary, as it does not always provide clear results.

N. Lansubsakul *et al.* (2022) established that bacteriological analysis of vaginal discharge is not effective for diagnosis, as similar microorganisms can be present in healthy dogs. Palpation of the abdominal wall can reveal an enlarged uterus. Visual diagnosis is quite useful for determining the size of the uterus and ruling out other possible causes of its enlargement. According to research by R.S. Kumar *et al.* (2023), radiography often shows the presence of a large tubular structure in the anteroposterior part of the abdominal cavity. The ultrasound method is better at detecting pathological changes, such as the size of the uterine cavity, especially when exudate is present and the diameter of the uterus remains within normal limits; changes in the tissues of the uterus (thickening) and ovaries (cysts).

L.E. Lavin & L.C. Maki (2023) established that among the possible differential diagnoses, mucometra, hydrometra, and hematometra should be excluded, as they present with similar symptoms and cause similar results on ultrasound examination of the uterus. Vaginal cytology often reveals marked signs of degeneration in leukocytes, neutrophils, macrophages, plasma cells, and lymphocytes, but phagocytosis of bacteria is not always observed. N. Lansubsakul *et al.* (2022) noted that vaginoscopy can

be useful for establishing the origin of vaginal discharge and excluding other pathologies, but its use is not typical in new clinical settings.

A preliminary diagnosis of this disease is made based on the medical history, results of clinical and gynaecological examinations, blood tests (haematological and biochemical), and results of ultrasound or radiographic examination. Confirmation of the diagnosis of pyometra occurs through macroscopic and histological analysis of the uterus and ovaries after surgery, as well as through bacteriological analysis of the uterine contents.

The chronic form of pyometra may manifest without clear visible signs (subclinical). The diagnosis of subclinical pyometra can be established using ultrasonography. S. Ahn *et al.* (2021) proved that the traditional method of treating pyometra is the surgical removal of the uterus along with the ovaries, which allows for the rapid and final removal of the pathological contents of the uterus and the cessation of toxins entering the general bloodstream. The disadvantages of surgery include the risk of anaesthesia and the factors of sterility. The optimal and safest way to treat pyometra is surgical removal of both the ovaries and the infected uterus, known as ovariohysterectomy. This procedure is also commonly used to sterilise females to prevent the occurrence of pyometra.

Research by V. Suchan *et al.* (2019) has shown that the simultaneous removal of the uterus and ovaries is the most effective method of treatment, as it eliminates the source of infection, preventing the possibility of the disease recurring. Many experts argue that surgical treatment is the only reliable method for treating the accumulation of purulent exudate in the uterine cavity in dogs with a closed cervix. However, the technique of ovariohysterectomy differs from female sterilisation, as it needs to be performed in such a way that the uterine contents do not enter the abdominal cavity.

If this condition is not met, it can lead to the development of peritonitis and, consequently, the need for additional antibiotic therapy, and in severe cases, additional surgery to clean and drain the abdominal cavity, which can lead to the formation of adhesions in the postoperative period. In any case, whether performed by a retrograde or direct method, the uterus is removed along with the cervix, leaving only the vaginal stump in the abdominal cavity. If the cervix with the stump is left in the abdominal cavity, there is a risk not only of pyometra recurring but also of developing cervical cancer.

C.H. Santana & R.L. Santos (2021) found that pyometra is a common disease in unmated female dogs. Approximately 20-25% of unmated females develop the condition before the age of 10. The recommended treatment is ovariohysterectomy. Complications such as peritonitis, urinary tract infections (UTIs), wound infections, and even death after surgery have been recorded in approximately 25% of cases. If signs of complications arise, an ultrasound examination of the abdominal cavity is usually performed to rule out peritonitis, abscessation of the cervix, bleeding, and/or UTI. However, the echographic characteristics of a normal postoperative abdomen may overlap with potential pathological findings. Common surgical reactions, such as hyperechoic fat, pneumoperitoneum, peritoneal effusion, and postoperative ligature absorption, can be difficult to distinguish from postoperative peritonitis and cervical abscessation (Nilsson *et al.*, 2023).

After a comprehensive review of the available literature, few published studies were found that describe the echographic characteristics of the abdominal cavity following ovariohysterectomy in dogs for the treatment of pyometra. To date, only a few studies have described the typical echographic pattern of the abdomen in dogs after any surgical procedure. Therefore, veterinary clinicians may find it difficult to

determine whether the observed reactions during an ultrasound examination are part of the normal postoperative process or indicative of postoperative complications.

Materials and Methods

The study was conducted following ethical standards and principles of humane animal care. All procedures, including diagnostics and surgery, were performed by accepted veterinary medical standards and the recommendations of the IASP Guidelines for the Use of Animals in Research (n.d.). All dog owners provided written informed consent for the inclusion of their animals in the study and the performance of all necessary medical procedures. All animals received adequate pre-operative preparation, anaesthesia, and postoperative care, tailored to their individual needs and promoting rapid recovery from surgery.

All examinations were performed on 23 March 2021, according to a standard protocol and were conducted in B-mode using a GE (Logiq E9) ultrasound machine with a linear transducer (9-11 MHz). The GE LOGIQ E9 ultrasound system is a modernised version of the previous generation flagship LOGIQ 9 equipment from the American company GE (General Electric). During ultrasound scanning, all dogs were positioned in a supine position. The standardised ultrasound examination procedure began with A-FAST (Abdominal Focused Assessment with Sonography for Trauma) to detect free fluid. If an abdominal fluid score (AFS) was detected, this information was recorded in the patient's medical history. Following A-FAST, an assessment of the upper abdomen was performed to detect the presence of pneumoperitoneum.

Several statistical methods were employed to analyse the data, appropriate to the type and nature of the data collected. Descriptive statistics were used to calculate mean, standard deviation, median, minimum, and maximum

values for quantitative variables such as haematological and biochemical blood parameters. To compare mean values between groups, an independent samples t-test or Mann-Whitney U test was used. Correlation analysis was used to assess the relationship between clinical and laboratory parameters, employing Pearson's or Spearman's correlation coefficient. Regression analysis helped to identify dependencies between different factors, and analysis of variance (ANOVA) was used to compare mean values in more than two groups. All statistical analyses were performed using SPSS software (version 25) or R (version 4.0.2), with the significance of differences considered statistically significant at a p-value of <0.05.

A convenience sample of privately owned dogs exhibiting clinical signs typical of pyometra, including vaginal discharge, polyuria, polydipsia, loss of appetite, vomiting, lethargy, fever, and visually confirmed purulent content, were included in the study following informed consent from the owners. The study population consisted of female dogs – patients of the veterinary clinic over the past six months and diagnosed with pyometra based on the results of clinical and laboratory examinations. The progression of pyometra in dogs was assessed based on the conducted studies.

Most of the studies were conducted on animals with clinical signs typical of pyometra, which were hospitalised with obvious symptoms of the disease. The diagnosis of pyometra was based on the results of medical history, clinical and laboratory examinations, and analysis of morphological and biochemical blood parameters using standard methods. For this purpose, an automated haematology analyser Sysmex XS-1000i (Japan) was used to count the number of erythrocytes, leukocytes, and thrombocytes, and a biochemical analyser Roche Cobas c311 (Switzerland) was used to determine the levels of urea, creatinine, total

protein, and other parameters. Ultrasound examination of the uterus and ovaries was used for additional diagnostic clarification. An assessment of the animals' living conditions and the nature of their care, including an analysis of their diet, was also conducted. Most of the animals (six individuals) were kept in outdoor environments, while four were housed indoors. The dietary regimens of the animals varied. All animals exhibited satisfactory feeding and housing conditions.

The clinical examination involved a general physical examination of the animals presented to the clinic, taking into account their breed and age. This included inspection, percussion, and palpation, determination of habitus and constitution, assessment of limbs, condition of all body systems, measurement of body temperature, and assessment of pulse and respiratory rate. The general condition of the sick animals was assessed by visual examination. The diagnosis was established using bimanual palpation, revealing an enlarged and thickened uterus, sometimes with the presence of ampullary dilations and septa. Ultrasound diagnosis was used to confirm the diagnosis, showing an enlarged uterus with a hypoechoic structure. When making a diagnosis, the main physiological parameters, the general condition of the animal, the condition of the mucous membranes, the condition of the hair coat, changes in food and water intake, and the nature of the vaginal discharge were taken into account.

Preoperative preparation involved subcutaneous injection of atropine sulphate in a 0.1% solution at a dose of 0.2-0.5 mL depending on the weight of the dog, intramuscular injection of diphenhydramine in a 1% solution (1-2 mL) and acepromazine in a 2% solution (0.5 mL/10 kg weight). For general anaesthesia, a 2% solution of xylazine was used at a dose of 0.1-0.15 mL/kg. Before surgery, the surgical field was disinfected. Access to the surgical

area was gained along the linea alba at the level of the posterior pair of mammary glands, performing a supravaginal extirpation of the uterus together with the ovaries. For premedication 30 minutes before the main anaesthesia, atropine sulphate at a dose of 0.1-0.5 mL/10 kg, diphenhydramine at a dose of 0.2 mg/kg, and xylazine at a dose of 0.15 mL/kg were used. Ketamine was utilised as the primary anaesthetic at a dose of 1 mL/kg. The animal was secured on the surgical table in a supine position.

The surgical procedure involved a laparotomy along the linea alba, during which, after incision of the skin, muscle layer, and peritoneum, the uterus was carefully exteriorised, avoiding the possible rupture of it and its blood vessels. After the uterus was fully exteriorised and placed on a sterile surgical drape, using a haemostatic clamp, the mesovarium was punctured beneath the ovarian-uterine artery. A haemostat was then applied to the ovarian pedicle, and a catgut suture was placed above the clamp. A second clamp was similarly positioned at the uterotubal junction, and a suture was applied beneath this clamp. Using this ligature, the uterine artery was ligated and severed between the two clamps. After that, the broad ligament of the uterus was incised outside the uterine artery up to the body of the uterus, allowing the uterine horn to be freely retracted backwards. The same actions were performed on the other uterine horn.

Before performing the amputation of the uterus, the anterior portion of the abdominal wall wound was closed using several individual sutures to prevent the evisceration of internal organs. A haemostatic clamp wrapped in gauze was placed at the level of the cervix, and the longitudinal arteries of the cervix (the uterine-vaginal arteries) were ligated. Subsequently, a tight ligature was applied as a transverse stitch around the entire body of the uterus, positioned approximately 2-3 cm below the

haemostatic clamp. The excision was carried out along the posterior line of the haemostatic clamp. Prior to excision, a gauze swab was placed beneath the incision site. The stump was treated with iodine, creating a groove to fold the uterine wall inward before suturing. Finally, the stump was dusted with an antibiotic and re-introduced into the abdominal cavity.

All dogs included in the study underwent three consecutive standardised ultrasound examinations of the abdominal cavity. These examinations were conducted the day after surgery, on the 5th day post-surgery, and on the 10th day, which was also the day of suture removal. Ultrasound examinations were performed according to a standard protocol using a GE ultrasound machine (Logiq E9) and a linear transducer (9-11 MHz) in B-mode. The dogs were in the supine position during the ultrasound examination.

The protocol for the ultrasound examination began with the performance of A-FAST (Abdominal Focused Assessment with Sonography for Trauma) to detect free fluid. If abdominal fluid was identified, this information was recorded in the patient's medical history. Following A-FAST, an assessment of the upper abdomen was conducted to check for pneumoperitoneum. The video of the cervical hinge was taken in both longitudinal and transverse planes, from left to right and caudally to cranially, respectively. Static images were utilised to capture the maximum longitudinal size of the cross-sectional area of the medial iliac lymph nodes, obtained using a transducer positioned ventrolaterally on the dog's body and angled at approximately 45° to the mid-sagittal plane. The video loop in the sagittal plane over the left and right areas of the mesovarium was recorded from a lateral to a medial direction.

Results and Discussion

In this study, ultrasound examinations were performed on 10 dogs with a confirmed

diagnosis of pyometra. It was found that in 85% of cases, the pathologically altered uterus had the characteristics of an enlarged, distended tubular structure. In 15% of cases, despite the normal size of the uterus, ultrasound examination revealed the presence of intrauterine fluid.

Following ovariectomy, within 2-3 days post-surgery, 90% of dogs showed improvement in their overall condition, normalisation of vital functions, and the absence of clinical signs of disease. According to an ultrasound examination 10 days post-surgery, all animals had a stable condition and no complications. At the same time, the study confirmed that the clinical manifestations of pyometra in female dogs depend significantly on the state of the cervix, i.e., whether it is open or closed. An open cervix allows the drainage of purulent fluid, whereas with a closed form, such discharge is not observed, leading to more severe symptoms due to endotoxemia and an increase in uterine size.

Purulent inflammation of the uterine lining was accompanied by vaginal discharge, which varied in colour from light red to brown. However, these discharges may not be present, depending on the degree of cervical opening. Pyometra is characterised by thick, purulent discharges of a yellowish-red, brown, or dark brown colour with a foul odour, although sometimes odourless, as found in 80% of cases. General nonspecific symptoms included loss of appetite, general weakness, excessive thirst, frequent urination, vomiting, fever, tachycardia, and tachypnoea. In cases of severe intoxication, hyperthermia, lethargy, and diarrhoea may be observed, especially with severe systemic inflammatory response syndrome.

With the open form, external signs can be detected due to vaginal discharge. The closed form often manifests with severe symptoms due to an enlarged uterus and endotoxemia. Sepsis, toxemia, shock, elevated body temperature, significant abdominal distension, and tension

of the hair coat may occur. Ultrasound has been established as the most accurate method for diagnosing pyometra, allowing the detection of even small amounts of intrauterine fluid and abnormal changes in the ovaries and uterine tissues. Ultrasound shows a swollen uterus with anechoic cysts due to pus accumulation. Histopathological analysis revealed cystic endometrial hyperplasia, wall thickening, inflammatory cells, and bacterial colonies.

E. Porowska *et al.* (2018) demonstrated that the severity of clinical signs depends on the degree of cervical opening, which may be sufficient for drainage of the pathological exudate. Purulent endometritis is accompanied by vaginal discharge of red and brown colour. This secretion is characteristic of inflammation of the uterine lining, but its amount directly depends on the degree of cervical opening, and in some cases is completely absent. In cases of pyometra, the discharge has a thick, purulent consistency, a yellowish-red, brown or dark brown colour, and a foul odour, but may sometimes be odourless.

In 80% of cases, such discharges were detected. Animals often exhibited general non-specific symptoms, such as loss of appetite, general weakness, increased thirst, increased urination, vomiting, fever, tachycardia, and tachypnoea. Lethargy and diarrhoea were also observed among these clinical signs, especially with the development of severe systemic inflammatory response syndrome. Hyperthermia in more than 20% indicated the presence of fever. Temperature increased in the early stages of the disease but then often returned to normal or lower values. The animal's condition and the condition of its coat depended on how quickly the pathological process progressed. Occasionally, intoxication, severe anaemia, and shock were observed.

According to R. Hagman (2018), pyometra in female dogs can be classified into two forms based on the condition of the cervix: closed

and open. The clinical manifestations in cases where the cervix is closed are often more severe than in those where it is open, as the animals experience an increase in uterine size and escalating endotoxemia. Such pathological changes frequently lead to uterine rupture and provoke the development of sepsis. In the closed form of purulent inflammation of the endometrium, the clinical symptoms are not pronounced in the initial stages of the disease and typically appear only after general intoxication. In cases of severe intoxication, hyperthermia, significant abdominal distension, and a ruffled coat may be observed. D. Talukdar *et al.* (2022) demonstrated that among the symptoms of pyometra with a closed cervix, depression, lethargy, vomiting, septicaemia, toxæmia, and shock may occur. The researchers emphasised that sepsis and life-threatening toxicosis necessitate the immediate removal of the source of pathogenic microorganisms through the administration of appropriate antibacterial agents.

V. Sachan *et al.* (2019) found that female dogs with pyometra can experience an increase in white blood cell count to levels ranging from 15,000 to 60,000/mm³. In the “closed” form of pyometra, ultrasound and X-ray examinations revealed a fluid-filled uterus, and histological examination of the uterine horns and body showed cystic endometrial hyperplasia, wall thickening, and inflammatory cells in the glandular and endometrial areas, as well as bacterial colonies. Along with pyometra, a significant increase in the number of macrophages and neutrophils in the endometrium was observed. In most situations where pyometra is suspected, ultrasonography is used for diagnostic imaging. Using this method, accurate information is obtained about the size, wall thickness of the uterus, the presence of cysts or fibrosis in the endometrium, and the presence of uterine fluid. The detection of uterine blood vessels, according to R.G.C. Xavier *et al.* (2024), helps to

differentiate pyometra from mucometra in cases where the uterus is filled with fluid.

A.K. Ahuja *et al.* (2019) demonstrated that ultrasonography is the most accurate method for diagnosing pyometra, as it allows for a qualitative and quantitative assessment of the uterine condition. In cases of pyometra, the uterus is usually swollen, and anechoic cysts are visualised due to the accumulation of pus. G. Mantziaras & G. Luvoni (2020) found that the advantage of ultrasonography is the ability to detect even small amounts of intrauterine fluid, as well as abnormal changes in the ovaries and uterine tissues. Depending on the degree of uterine involvement, the ultrasound signs of pyometra may vary. Areas of uterine damage may appear as hypoechoic or anechoic regions. For example, with moderate uterine involvement, the uterus may appear as a hypoechoic, almost round structure, located ventrally and ventrolaterally to the anechoic urinary bladder on transverse scanning.

R.S. Kumar *et al.* (2023) determined that cystic endometrial hyperplasia (CEH), which precedes the development of pyometra, can appear as small, fluid-filled cysts on an ultrasound of the endometrium. Transabdominal ultrasonography is an effective method for diagnosing the closed form of pyometra. Characteristic signs include multiple anechoic cysts with altered uterine wall thickness. Thus, ultrasound can be used as a rapid and non-invasive method for detecting uterine pathologies such as CEH and pyometra.

R.G.C. Xavier *et al.* (2024) noted that in clinically healthy animals, the anatomical and topographical position of the uterus can complicate its visualisation using ultrasonography, as the cervix and body of the uterus are located posteriorly in the pelvic cavity, between the loops of the intestine, while the uterine horns are situated above the bladder in the abdominal area. Meanwhile, a full urinary bladder can

create an acoustic window by displacing the intestinal loops, facilitating the visualisation of a uterus with limited content or a healthy uterus. However, if the uterus is located higher than a full urinary bladder, most often only the cervix and body of the uterus can be seen, which on the ultrasound appear as elongated structures with a hypoechoic structure. Identifying the uterine horns on the sonogram can be challenging, as they are often indistinguishable from the intestinal loops. Nevertheless, when there are secretions, even with a small amount of mucus, the uterine horns can be readily visualised. During ultrasonography, they exhibit smooth walls of moderate echogenicity, and no cavities are observed. In the case of inflammatory processes within the uterus, the

cavities of the horns may fill with inflammatory exudate, leading to an increase in horn diameter. The presence of exudate within the cavities of the uterine horns can be clearly visualised from any point on the abdominal wall during ultrasonography.

Typically, female dogs with pyometra exhibited characteristic ultrasonographic findings that included enlarged uterine horns, which appeared as round anechoic structures located beneath the urinary bladder. The uterine body could also be enlarged, with anechoic content in the horn cavities, which could be homogeneous or heterogeneous. The uterine walls were usually of increased echogenicity and heterogeneous, and thickening of the endometrial walls was also observed (Fig. 1).

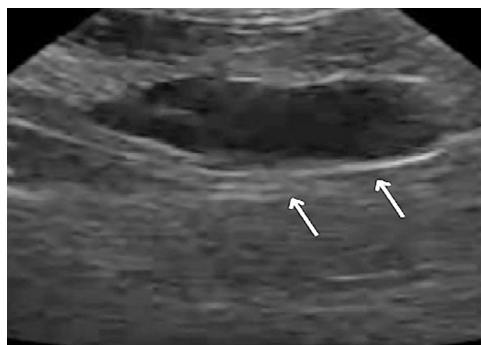


Figure 1. Ultrasound image of pyometra in female dogs

Note: arrows in the figure indicate the pathological process within the uterus in cases of pyometra

Source: author's material

Ultrasonography proved to be informative in detecting intrauterine fluid even when the diameter of the uterus remained within normal limits. Additionally, it had the advantage of detecting further pathological changes in tissues and ovaries, such as ovarian cysts or cystic endometrial hyperplasia. During the study, a situation arose where the left uterine horn was enlarged to 4.3 cm, as seen on a transverse section, and it had hypoechoic content, indicating the presence of pyometra.

S. Ahn *et al.* (2021) concluded that endometritis in carnivores is rarely responsive to conservative treatment and recommended surgical treatment – ovariohysterectomy. M.K. Nilsson *et al.* (2023) insisted that the most effective method of treatment and prevention of recurrences is a combination of ovariohysterectomy and antibiotic therapy. This method allowed for rapid removal of purulent content from the uterus and reduced the manifestation of intoxication of the organism. However, it has

its drawbacks. Firstly, surgery is always associated with the risks of anaesthesia and postoperative complications. Secondly, ovariohysterectomy involves the sterilisation of the female, which is not optimal for breeding or purebred animals kept for breeding. Despite the widespread use of ovariohysterectomy, it has its risks and leads to a complete loss of the female's reproductive function.

The blood vessels supplying the uterus are located on both sides: on one side is the ovarian-uterine artery, on the other – the uterine artery. A collateral branch of the posterior aorta is the ovarian-uterine artery, which penetrates the mesovarium and branches into two parts: one supplies the ovary, and the other supplies blood to the anterior part of the uterine horn and broad uterine ligament. This artery connects anteriorly with the ovarian artery, posteriorly with a branch of the vaginal artery. During pregnancy and pyometra, the uterine artery increases significantly in size. During all stages of the operation, special care was taken to interact with the uterus, which contains purulent content. Accidental movements of the instruments can lead to perforation of the uterus and leakage of pus into the abdominal cavity. Adequate anaesthesia during surgery for pyometra is critically important, as it provides continuous monitoring, and prevents complications

that may arise due to impaired cardiovascular, respiratory, and haemostatic functions. Since pyometra causes toxic effects on all organs, the choice of anaesthetics should be based on previous clinical studies of the animal.

This study sought to describe the postoperative ultrasonographic features of the cervical stump, mesovarium ligatures, medial iliac lymph nodes, and surrounding abdominal tissues at various time points following surgery in a group of dogs with pyometra and a group of dogs without postoperative complications. The hypotheses predicted that the size and other characteristics of the cervical stump, mesovarium region, and medial iliac lymph nodes would differ at three different time points of examination.

The ultrasound examination revealed the following. Assessment of abdominal fluid volume showed a decrease by the 10th day compared to the 1st and 5th days post-surgery. On the 1st and 5th days, free fluid was found in 60% and 50% of dogs, respectively, while after 10 days, fluid was found in only 20% of dogs. Pneumoperitoneum was observed in 30% of dogs on the 10th day compared to 90% and 70% at the previous control points. The results of the assessment of abdominal fluid volume and the number of dogs with free fluid and pneumoperitoneum at three examination points are presented in Table 1.

Table 1. Assessment of abdominal fluid and the number of dogs with free fluid and pneumoperitoneum at three time points after ovariohysterectomy in 10 female dogs diagnosed with pyometra

Parameter	Day 1, quantity (%)	Day 5, quantity (%)	Day 10, quantity (%)
Free fluid	6 (60%)	5 (50%)	2 (20%)
Pneumoperitoneum	9 (90%)	7 (70%)	3 (30%)
Abdominal fluid indicator			
0	6 (60%)	7 (70%)	9 (90%)
1	4 (40%)	5 (50%)	1 (10%)

Table 1. Continued

Parameter	Day 1, quantity (%)	Day 5, quantity (%)	Day 10, quantity (%)
Abdominal fluid indicator			
2	2 (20%)	0 (0%)	0 (0%)
3	1 (10%)	0 (0%)	0 (0%)
4	0 (0%)	0 (0%)	0 (0%)

Note: the assessment of the volume of abdominal fluid involved the following values: 0 – no fluid, 1 – the presence of fluid in one quadrant of the abdominal cavity, 2 – in two quadrants of the abdominal cavity, 3 – in three quadrants of the abdominal cavity, 4 – in all four quadrants of the abdominal cavity

Source: developed by the author

In all 10 dogs, the cervical stump was examined at all selected time points. The stump had a mixed echogenicity with a hypoechoic central region and a hyperechoic rim of varying thickness. There was a relationship between body weight and the cross-sectional area of the cervix. The area of the stump varied from 75 to 716 mm³ on the 1st day, from 156 to 887 mm³ on the 5th day, and from 108 to 558 mm³ on the 10th day. Areas of the mesovarium were found in all 10 dogs over the three days of observation. They appeared as hyperechoic heterogeneous areas with shadows at the edges or central shadowing artefacts.

The cervical stump increased in size up to the 5th day post-operatively compared to subsequent days. The size of the mesovarium ligature reaction remained stable at all selected time points of the study. The study suggests that the cervical stump, the reaction to mesovarium ligatures, and the medial iliac lymph nodes can be effectively visualised using ultrasonography after ovariohysterectomy. It is noteworthy that the details and size of the cervical stump varied significantly between individuals.

All images and videos were stored, and video loops were played to assess the margins of the cervical stump and the reaction of the mesovarium ligature. For measurements, frames with the maximum cross-sectional area were used, later defined as size. The maximum length of

the cervical stump was measured in the longitudinal plane, placing the callipers at the level of the ligature and the external cranial edge of the hyperechoic area, defined as the cervix. The maximum height of the cervix in the longitudinal view was measured in two places – cranial and caudal to the ligature, placing the callipers at its extreme ventral and dorsal external edges. In the transverse plane, a frame containing the cervical stump at its maximum size was used. At this point, measurements were taken of both the maximum diameter (referred to as width) and the orthogonal diameter (referred to as height). The cross-sectional area of the cervical stump was calculated by indicating the outer hyperechoic edge at eight different points to cover the area of interest. The maximum length of the mesovarium reaction was measured parallel to the long axis of the transducer scanning plane, placing the callipers on its outer hyperechoic edges. The point of its maximum height was identified and measured perpendicular to the length. The maximum height and length of the medial iliac lymph nodes were measured on still images. The characteristics of the cervical stump, mesovarium reaction, and medial iliac lymph nodes were documented.

The present study confirmed the effectiveness of using ultrasound diagnostics for the early detection of pyometra in dogs and for assessing post-operative conditions. Ultrasound

proved useful in detecting intrauterine fluid even in cases where the size of the uterus was within normal limits. Ultrasound examinations conducted on the 1st, 5th, and 10th days post-surgery provided objective data on the animals' condition and revealed even minor complications. This confirms the high diagnostic value of ultrasound.

The results of the study showed that ovari-hysterectomy is the most effective method for treating pyometra, contributing to the normalisation of vital functions as early as 2-3 days post-surgery. This is consistent with the findings of a study by S. Ahn *et al.* (2021), who also emphasised the importance of surgical intervention for the treatment of pyometra and the improvement of clinical parameters in dogs.

In the study by B. Gasser *et al.* (2020), the importance of timely diagnosis of pyometra to prevent sepsis and kidney failure was noted, confirming the value of ultrasound as a rapid and non-invasive method. P.R. Batista *et al.* (2022) evaluated the use of Doppler ultrasound to assess the condition of dogs after medical treatment for pyometra, emphasising that this technique also has high diagnostic value, although it requires extensive training and specialised equipment compared to traditional ultrasound.

A.J.R. Peixoto *et al.* (2023) highlighted the importance of a comprehensive approach to the treatment of pyometra, including the assessment of systemic inflammatory response and organ dysfunction, emphasising the need for a multi-faceted diagnostic approach to improve treatment efficacy and reduce mortality. P.M. Sklyarov & V.V. Piatibrat (2021) and D.V. Zarutskaya (2022) also confirmed the high diagnostic value of ultrasound for detecting pyometra in dogs and its complications. They emphasised the need for early diagnosis and timely surgical intervention to improve treatment outcomes.

Thus, the present study affirmed the effectiveness of ultrasound in the diagnosis of pyometra and postoperative monitoring. Comparison with other studies showed that the results are generally consistent with the existing literature, underlining the importance of ultrasound diagnosis and surgical treatment for reducing mortality and improving the quality of life of dogs with pyometra.

Conclusions

Pyometra in dogs is a dangerous infectious disease that requires immediate diagnosis and treatment to prevent complications such as multiple organ dysfunction, particularly kidney damage due to endotoxins. The study established that ultrasound is a highly effective method for detecting pyometra in dogs, allowing for the timely identification of pathological changes in the uterus and the implementation of appropriate surgical intervention.

Ultrasound examinations performed using a GE (Logiq E9) machine demonstrated high informativeness and accuracy in the diagnosis of pyometra. Diagnostic criteria, including the presence of purulent material in the uterus, increased uterine size, and changes in the uterine wall structure, correlated with the results of clinical and laboratory investigations, confirming their reliability. A comparison of the effectiveness of different treatment methods for pyometra revealed that ovario-hysterectomy was the fastest and most effective method. After surgery, the inflammatory process ceased immediately, which had a positive impact on the animal's health. In most cases, the normalisation of vital functions in patients was observed within 2-3 days after surgery, whereas with conservative treatment, this period lasted up to 10 days.

Following surgical treatment, a series of follow-up ultrasound examinations were conducted to assess the state of the abdominal

cavity and the healing process. Ultrasound characteristics were established for each examination, including features of the cervical stump and mesovarium, size and echogenicity of the medial iliac lymph nodes, as well as the presence of free peritoneal fluid and pneumoperitoneum. In all dogs, the cervical stump had a heterogeneous appearance with a hypochoic centre surrounded by hyperechoic tissue.

It should be noted that ultrasound is a non-invasive and rapid diagnostic method for detecting pyometra, even small fluid collections. Changes in the uterus on ultrasound typically appeared as an enlarged, distended tubular structure with anechoic or hypochoic content. Therefore, ultrasound is an effective diagnostic tool for both qualitative and quantitative assessment of pyometra in female dogs, significantly contributing to the treatment process both during surgery and in the postoperative recovery period.

Future research directions include analysis of long-term outcomes after ovariohysterectomy and refinement of ultrasound techniques to improve diagnosis and monitoring of animals post-surgery.

Acknowledgements

The author would like to express sincere gratitude to the staff of the Educational, Scientific, and Production Clinic of Veterinary Medicine and the Department of Surgery and Obstetrics (T.V. Zvenihorodska and other colleagues), as well as to the students of the Faculty of Veterinary Medicine at Poltava State Agrarian University, who participated in the examinations and provided medical care to the dogs that were patients in this study. Special thanks to the pet owners for their cooperation and consent to participate in the research.

Conflict of Interest

None.

References

- [1] Ahn, S., Bae, H., Kim, J., Kim, S., Park, J., Kim, S.-K., Jung, D.-I., & Yu, D. (2021). [Comparison of clinical and inflammatory parameters in dogs with pyometra before and after ovariohysterectomy](#). *BMC Veterinary Research*, 85, 271-278.
- [2] Ahuja, A.K., Honparkhe, M., & Sethi, G.S. (2019). [Association of canine pyometra with systemic inflammatory response syndrome](#). *Journal of Entomology and Zoology Studies*, 20197(1), 1409-1412.
- [3] Batista, P.R., Gobello, C., Rube, A., Barrena, J.P., Arioni, S., & Blanco, P.G. (2022). Doppler ultrasonographic evaluation of medically treated female dogs with cystic endometrial hyperplasia-pyometra complex. *Veterinary Radiology & Ultrasound*, 63(4), 490-497. [doi: 10.1111/vru.13079](#).
- [4] Gasser, B., Uscategui, R.A.R., Maronezi, M.C., Pavan, L., Simões, A.P.R., Martinato, F., Silva, P., Crivellenti, L.Z., & Feliciano, M.A.R. (2020). Clinical and ultrasound variables for early diagnosis of septic acute kidney injury in bitches with pyometra. *Scientific Reports*, 10(1), article number 8994. [doi: 10.1038/s41598-020-65902-4](#).
- [5] Hagman, R. (2018). Pyometra in small animals. *The veterinary clinics of North America: Small Animal Practice*, 48(4), 639-661. [doi: 10.1016/j.cvsm.2018.03.001](#).
- [6] Hagman, R. (2022). Pyometra in small animals 2.0. *Veterinary Clinics of North America: Small Animal Practice*, 52, 631-657. [doi: 10.1016/j.cvsm.2022.01.004](#).
- [7] IASP Guidelines for the Use of Animals in Research. (n.d.). Retrieved from <https://www.iasp-pain.org/resources/guidelines/iasp-guidelines-for-the-use-of-animals-in-research/>.

- [8] Kumar, R.S., Rasool, A., Umamageswari, J., Sarath, S., & Rangasamy, S. (2023). Ultrasonographic evaluation of canine pyometra. *Journal of Dairy, Veterinary & Animal Research*, 12(1), 5-6. doi: [10.15406/jdvar.2023.12.00314](https://doi.org/10.15406/jdvar.2023.12.00314).
- [9] Lansubsakul, N., Sirinarumitr, K., Sirinarumitr, T., Imsilp, K., Wattananit, P., Supanrung, S., & Limmanont, C. (2022). First report on clinical aspects, blood profiles, bacterial isolation, antimicrobial susceptibility, and histopathology in canine pyometra in Thailand. *Veterinary World*, 15, 1804-1813. doi: [10.14202/vetworld.2022.1804-1813](https://doi.org/10.14202/vetworld.2022.1804-1813).
- [10] Lavin, L.E., & Maki, L.C. (2023). Antimicrobial use in the surgical treatment of canine pyometra: A questionnaire survey of Arizona-licensed veterinarians. *Veterinary Medicine and Science*, 9(3), 1124-1133. doi: [10.1002/vms3.1130](https://doi.org/10.1002/vms3.1130).
- [11] Llazani, M., Heta, B., Qoku, A., & Dhaskali, L. (2021). [Diagnosis and medication of pyometra in a female dog](https://doi.org/10.1080/00036817.2021.1911111). *Anglisticum*, 10(5), 49-579.
- [12] Mantziaras, G., & Luvoni, G.C. (2020). Advanced ultrasound techniques in small animal reproduction imaging. *Reproduction in Domestic Animals*, 55(2), 17-25. doi: [10.1111/rda.13587](https://doi.org/10.1111/rda.13587).
- [13] Nilsson, M.K., Toresson, L., Ljungvall, I., Nyman Lee, H.T., & McEvoy, F.J. (2023). Sonographic features of the uncomplicated postoperative abdomen in dogs treated for pyometra by ovariohysterectomy. *Veterinary Radiology and Ultrasound*, 64(6), 1090-1098. doi: [10.1111/vru.13310](https://doi.org/10.1111/vru.13310).
- [14] Ovcharuk, N.P., & Kravchuk, O.O. (2016). [Diagnosis and problem of pyometra treatment in domestic dogs \(foreign and domestic experience\)](https://doi.org/10.1080/00036817.2016.1191111). *Young Scientist*, 2 (29), 173-177.
- [15] Pailler, S., Slater, M.R., Lesnikowski, S.M., Gayle, J.M., Duvieusart, C.B., Ledesma, E.J., Lee, M.L., Stevens, J.D., & DeClementi, C. (2022). Findings and prognostic indicators of outcomes for bitches with pyometra treated surgically in a nonspecialized setting. *Journal of the American Veterinary Medical Association*, 260(2), 49-56. doi: [10.2460/javma.20.12.0713](https://doi.org/10.2460/javma.20.12.0713).
- [16] Peixoto, A.J.R., Lima, V.C.T., Fernandes, M.E.d.S.L., Oliveira, L.C., Blanc, B.T., Barros, F.F.P.d.C., Knackfuss, F.B., Baldani, C.D., & Coelho, C.M.M. (2023). The impact of clinical presentation, presence of sirs and organ dysfunction on mortality in bitches with pyometra. *Ciência Rural*, 54(1), article number e20220219. doi: [10.1590/0103-8478cr20220219](https://doi.org/10.1590/0103-8478cr20220219).
- [17] Porowska, E., et al. (2018). Selected aspects of endometritis – pyometra complex in dogs – current troubles and treatment perspectives. *Medical Journal of Cell Biology*, 6(3), 108-113. doi: [10.2478/acb-2018-0017](https://doi.org/10.2478/acb-2018-0017).
- [18] Rautela, R., & Katiyar, R. (2019). Review on canine pyometra, oxidative stress and current trends in diagnostics. *Asian Pacific Journal of Reproduction*, 8(2), 45-55. doi: [10.4103/2305-0500.254645](https://doi.org/10.4103/2305-0500.254645).
- [19] Sachan, V., Kumar, A., Agrawal, J., & Saxena, A. (2019). Etiopathology and blood biochemistry alterations in canine pyometra: A review. *International Journal of Livestock Research*, 9, 352-354. doi: [10.5455/ijlr.20190410070331](https://doi.org/10.5455/ijlr.20190410070331).
- [20] Santana, C.H., & Santos, R.L. (2021). Canine pyometra – an update and revision of diagnostic terminology. *Brazilian Journal of Veterinary Pathology*, 14(1), 1-8. doi: [10.24070/bjvp.1983-0246.v14i1p1-8](https://doi.org/10.24070/bjvp.1983-0246.v14i1p1-8).
- [21] Sklyarov, P.M., & Pyatibrat, V.V. (2021). Diagnostic aspects of female pyometra (review information). *Scientific Bulletin of Veterinary Medicine*, 2, 18-36. doi: [10.33245/2310-4902-2021-168-2-18-36](https://doi.org/10.33245/2310-4902-2021-168-2-18-36).

- [22] Suchan, V., Agrawal, J.K., Kumar, A., & Saxena, A. (2019). [Diagnosis and treatment of canine pyometra: A Review](#). *Journal of Entomology and Zoology Studies*, 7(2), 939-942.
- [23] Talukdar, D., Sarma, K., Konwar, B., Tolenkhomba, T.C., Talukdar, P., Islam, S.J., Deka, A., & Garg, A. (2022). Clinico-haemato-biochemical and pathological alteration of pyometra in canines. *Indian Journal of Animal Research*, 44, 1-7. [doi: 10.18805/IJAR.B-4684](#)
- [24] Woźna-Wysocka, M., Rybska, M., Błaszak, B., Jaśkowski, B.M., Kulus, M., & Jaśkowski, J.M. (2021). Morphological changes in bitches endometrium affected by cystic endometrial hyperplasia-pyometra complex the value of histopathological examination. *BMC Veterinary Research*, 17(1), article number 174. [doi: 10.1186/s12917-021-02875-0](#).
- [25] Xavier, R.G.C., Santana, C.H., da Silva, P.H.S., Paraguassú, A.O., Nicolino, R.R., Freitas, P.M.C., Santos, R.L., & Silva, R.O.S. (2024). Association between bacterial pathogenicity, endometrial histological changes and clinical prognosis in canine pyometra. *Theriogenology*, 214, 118-123. [doi: 10.1016/j.theriogenology.2023.10.007](#).
- [26] Zarutska, D.V. (2022). *Ultrasound examination of pyometra in dogs*. Retrieved from <http://ir.polissiauniver.edu.ua/handle/123456789/12864>.

Оцінка результативності хірургічного лікування із застосуванням сонографічної діагностики за піометри в собак

Ігор Дехнич

Аспірант

Полтавський державний аграрний університет
36003, вул. Сковороди, 1/3, м. Полтава, Україна
<https://orcid.org/0000-0001-5687-3765>

Анотація. Актуальність дослідження полягала в необхідності оцінки ефективності хірургічного лікування піометри в собак із використанням сонографічної діагностики. Піометра є однією з найпоширеніших репродуктивних патологій у сук, що у випадку запізнілої діагностики може призвести до розвитку небезпечних ускладнень – сепсису та ураження нирок. Ультразвукове обстеження є неінвазивним та ефективним методом діагностики піометри, яке є важливим інструментом для встановлення навіть незначних ускладнень після проведеної оваріогістеректомії та дозволяє здійснювати моніторинг стану здоров'я тварини. Мета цієї роботи полягала у виявленні ультразвукових характеристик черевної порожнини в собак, хворих на піометру, та порівняння післяопераційних ультразвукових характеристик черевної порожнини після оваріогістеректомії в динаміці у групі тварин з піометрою та без ускладнень. Провідним методом дослідження було поетапне і цілеспрямоване ультразвукове обстеження черевної порожнини в собак для виявлення піометри, далі під час оваріогістеректомії, а також на 1, 5 та 10 добу після операції. Встановлено, що патологічно змінена матка на ультразвуковому зображенні часто мала характеристики збільшеної, розтягнутої трубчастої структури з анехогенним або гіпоехогенним умістом. Ультразвукове дослідження хворих собак вирізнялось також діагностичною ефективністю у випадках візуалізації внутрішньоматкової рідини, навіть, коли розміри матки відповідали межах норми. Застосування сонографічної діагностики дозволяло своєчасно виявити піометру на ранніх стадіях, що значно поліпшувало ефективність подальшого лікування. Оваріогістеректомія виявилася найефективнішим методом лікування собак з піометрою, сприяючи нормалізації життєвих функцій вже на 2–3 добу після операції, що зменшувало ризик рецидивів. Ультразвукове дослідження черевної порожнини в динаміці після оперативного втручання забезпечувало своєчасну корекцію лікувальних заходів і покращення прогнозу для пацієнтів. Встановлені факти мають практичне значення для лікарів ветеринарної медицини, що сприятиме покращенню якості діагностики піометри у собак, ефективності їх лікування та зменшенню летальності

Ключові слова: патологія матки; ультразвукова діагностика; хірургічне втручання; післяопераційний період; внутрішньоматкова рідина; ускладнення