

# PRESERVING A BLOODLINE SMART STEPS TO ADDRESS CANINE PYOMETRA

Breeders have long grappled with when to breed a bitch having a successful show or sporting campaign. These accomplished females may be the linchpin of a legacy bloodline via their ability to produce the next generation of champions. Yet 20 percent of intact bitches<sup>1</sup> are at risk of developing the potentially fatal disease pyometra by 10 years of age — a disease that may end their chance of whelping puppies should it occur early in life.

“It is heartbreaking when breeders whose prized bitches just finished their careers tell how they assumed their only option to treat pyometra was spay surgery,” says Karen Von Dollen, DVM, MS, DACT, who completed a theriogenology residency at North Carolina State University in 2019 and is board-certified in veterinary reproduction.

“Although not every bitch is a candidate for medical treatment, a breeder’s goals for his or



Bitches that develop pyometra may require a life-saving ovariohysterectomy that would end their breeding career. Enjoying her third litter, “Emma” (Stay Not Sell Bella Mare) is a Labrador Retriever owned by Heidi Hartman of Lawtons, New York, and Sonia Czajor of Poland.

## PYOMETRA AT A GLANCE

**One in five bitches over age 10** develops pyometra<sup>1</sup>

**The mortality rate** for pyometra is up to 10 percent<sup>3</sup>

*Escherichia coli* (*E. coli*) is the **most common cause** of pyometra<sup>2</sup>

**The recurrence rate** for bitches medically treated for pyometra is up to 86 percent<sup>4</sup>

Information presented by Dr. Karen Von Dollen during an educational webinar that is part of the AKC Canine Health Foundation/VetVine canine health topics series.

<sup>1</sup> Jitpean S, et al. Outcome of Pyometra in Female Dogs and Predictors of Peritonitis and Prolonged Postoperative Hospitalization in Surgically Treated Cases. *BMC Veterinary Research*. 2014;10:6.

<sup>2</sup> Fransson B, et al. Bacteriological Findings, Blood Chemistry Profile and Plasma Endotoxin Levels in Bitches with Pyometra or Other Uterine Diseases. *Transboundary and Emerging Diseases*. 1997;44(7):417-426.

<sup>3</sup> Hagman R. Diagnostic and Prognostic Markers for Uterine Diseases in Dogs. *Reproduction in Domestic Animals*. 2014;49(Suppl 2):16-20.

<sup>4</sup> Jena B, et al. Physiological and Haematological Parameters of Bitches Affected with Pyometra. *Veterinary World*. 2013;6(7):409-412.

her kennel should be considered,” says Dr. Von Dollen, who studied antimicrobial treatments for pyometra during her residency program that was supported by the Theriogenology Foundation, American Kennel Club and AKC Canine Health Foundation.

An infection of the uterus, pyometra is Latin for “pus uterus.” Triggered most commonly by *Escherichia coli* (*E. coli*) bacteria, pyometra becomes dangerous when sepsis, endotoxemia or uterine rupture occur. Some bitches show no signs of pyometra until the illness is advanced and require emergency treatment to prevent overwhelming infection and death. Because pyometra is one of the most common reproductive emergencies, it is considered in any intact bitch that is sick.

Early detection of pyometra, more easily recognized in open cervix pyometra due to a vaginal discharge draining from the cervix, has a greater chance of success with medical management. However, up to 86 percent of bitches<sup>2</sup> medically treated for this reproductive disease will have a recurring episode.

If medical therapy is desired for bitches needed to help preserve a breeding program, diligent monitoring for possible harmful side effects from prostaglandin and antibiotic treatment is needed. Owners and veterinarians should work closely together to ensure a healthy recovery, while also being on guard for subsequent pyometra. Spay surgery is recommended after the bitch has produced puppies.

“Because of the significant risk that pyometra will return, I advise breeders to make every effort to breed a bitch on her next heat cycle following successful medical treatment of the disease. An idle uterus is the ideal setting for pyometra,” Dr. Von Dollen says.

Taking steps to optimize the potential for successful breeding after medical management is helpful. “This involves using precise ovulation timing, selecting a proven stud dog that has sired a litter within the previous six months, breeding twice during the fertile window, and

## SIGNS OF CANINE PYOMETRA

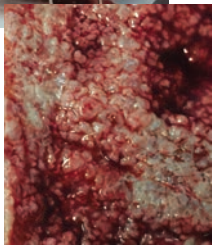
Recognizing pyometra can be challenging, as some bitches show only subtle signs that may go unnoticed until late in the illness. By then, the severity of the condition may be life-threatening. Board-certified veterinary reproduction expert Karen Von Dollen advises breeders and owners to monitor bitches closely during the two months following their heat cycle to help detect changes in attitude, appetite and behavior that could indicate pyometra.

Signs of pyometra include:

- Depression, lethargy or listless behavior
- Vomiting or diarrhea
- Anorexia or loss of appetite
- Pale mucous membranes
- Excessive water intake and excessive urination due to bacterial toxins that affect the kidney’s ability to retain fluid
- In open cervix cases, a purulent vaginal discharge from pus draining from the uterus may appear on the skin or hair under the tail or on bedding and furniture where the dog has lain
- In closed cervix cases, pus that is not able to drain collects in the uterus, causing abdominal distention, releasing toxins that are absorbed into the circulation, and making dogs severely ill very rapidly



Above: The excised uterus of a bitch that underwent ovariectomy for closed cervix pyometra is distended due to fluid accumulation. Right: The interior surface of the same uterus shows small, raised cysts, a condition known as cystic endometrial hyperplasia, which promote pyometra by providing an ideal environment for bacteria.



using intrauterine insemination,” says Dr. Von Dollen.

On the other hand, “if you are not planning to breed a bitch, spay is the recommended treatment for pyometra,” she says. An ovariectomy in which the ovaries and uterus are removed effectively eliminates the pus-filled uterus and prevents a recurrence of the disease.

Dr. Von Dollen cautions, “Owners of intact breeding bitches should not delay in breeding their animals. As soon as you have decided to breed your bitch and her show or performance career allows, you should breed her

to produce the desired litters needed to safeguard her genetics before she ages into a risky category for pyometra.”

## UNDERSTANDING A COMPLEX DISEASE

Pyometra is a complicated disease that is not well understood and varies among bitches. To help advance understanding, the AKC Canine Health Foundation is currently funding two

studies of canine pyometra. At the University of Helsinki in Finland, investigators are gathering insights about the effectiveness of antimicrobial treatment in bitches after ovariohysterectomy for pyometra out of concern about a possible detrimental effect from antimicrobial resistance. A research team at the University of Veterinary Medicine of Vienna in Austria is working on the first study to analyze the role of lipid composition and lipid droplets in pyometra cystic endometrial hyperplasia (CEH), a condition that promotes the proliferation of bacteria.

In pyometra, the uterus of affected females is filled with bacteria and inflammatory cells that could burst or seed its contents throughout the body at any time. If severe sepsis and organ failure develop, the prognosis is not favorable.

The nature of a bitch’s heat cycles along with hormonal changes and delayed breeding contribute to the development of pyometra. The hormones progesterone and estrogen fluctuate during a heat cycle and change the uterus in preparation for breeding and pregnancy.

“We know that the hormonal environment of the bitch lays the foundational groundwork for this disease to take hold. Over a bitch’s lifetime, the cumulative effect of the cyclic exposure to these hormones predisposes her to develop pyo-

## EVALUATING THE EFFECTIVENESS OF ANTIBIOTICS IN POSTOPERATIVE PYOMETRA

The risk of postoperative infection at the surgical site or in the urinary tract accounts for bitches being prescribed an antibiotic treatment for at least 10 days following spay surgery for pyometra. At the University of Helsinki, a study aims to determine the risk of postoperative infection and whether antibiotics are warranted.

“Our main goal of this study is to determine whether we could refrain from using antibiotics in these dogs without significantly increasing their risk for developing postoperative infections,” says lead investigator Sari Mölsä, DVM, PhD, DECVS. “The consequences of unnecessary antimicrobial use are already visible in veterinary medicine with bacterial infections being increasingly difficult to treat as the bacteria involved no longer respond to drugs available.”

Funded by the AKC Canine Health Foundation, the four-year study that began in September 2020 is following the occurrence of surgical site infections (SSIs) and urinary tract infections (UTIs) in postoperative pyometra patients. “We hypothesize that with current clinical practices and careful aseptic surgical techniques, the incidence of infections in these patients is very low,” Dr. Mölsä says.

“The risk for the development of SSIs in our patients at the University of Helsinki Veterinary Center is around 2 percent,”

she says. “Pyometra surgeries are generally classified as clean-contaminated as they involve incising the infected uterus. However, in these cases the infected focus is entirely removed, and therefore the need for postoperative antibiotics is questionable. Rare cases in which the uterus has ruptured before or during surgery, causing pus to leak into the abdomen, are considered contaminated or ‘dirty’ surgeries and are more likely to result in infection. These cases are more in need for postoperative antibiotics as there might be bacteria left in the abdominal cavity after surgery.”

Dr. Mölsä says that almost 70 percent of pyometra patients were believed to develop UTIs from studies conducted in the 1970s and 1980s, though the accuracy of the methods used to determine this incidence rate is dated. “Clinical experience has shown the incidence to be much lower than this, and now we are looking to prove this,” she says.

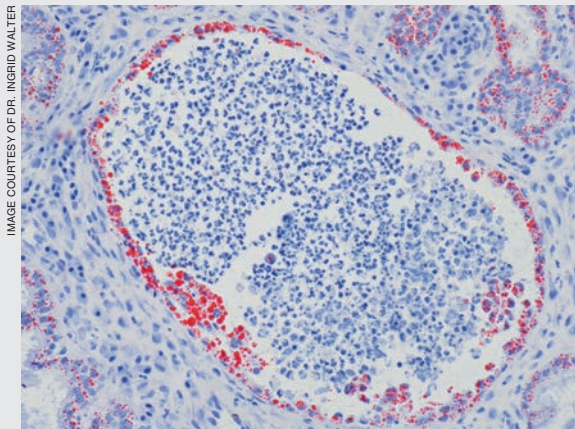
“We believe that in most pyometra patients, antibiotic treatment is unnecessary and may consequently disturb the intestinal microbiome, leading to digestive disorders, or cause the development of antimicrobial resistance,” says Dr. Mölsä. “We also hope to study the characteristics of the bacteria involved in causing canine pyometra and the risk factors for dogs developing pyometra.”



## ANALYZING THE ROLE OF LIPIDS IN PYOMETRA BACTERIAL INFECTIONS

The goal of an *in vitro* study underway at the University of Veterinary Medicine of Vienna is to demonstrate the functional role of lipid droplets (LD) involved in bacterial infections of canine endometrial epithelial cells (cEECs). The hypothesis contends that LD accumulation in cEECs promotes the bacterial infection of pyometra-affected cystic endometrial hyperplasia.

Ingrid Walter, PhD, head of the Vet Bio Bank, leads the AKC Canine Health Foundation-funded



This tissue sample has been stained to show lipid droplets in canine pyometra. The red represents lipid droplets, and the blue depicts cell nuclei.

investigation that will be completed in October 2021. “The modulation of host-lipid homeostasis is beneficial for bacteria, especially *E. coli* that are common in pyometra cases, as bacteria incorporate extracellular fatty acids into their membrane lipids and use host cholesterol as nutrition,” Dr. Walter explains.

“In this study, we have isolated cEECs and stimulated them with external fatty acids and/or cholesterol and then infected them with a pathogenic *E. coli* strain from a canine pyometra-affected uterus,” she says. “We plan to analyze the effect of this lipid enrichment on bacterial adherence and uptake to cEECs.”

An earlier study by this group identified increased amounts of lipid droplets in cEECs during early diestrus, the cyclic stage when pyometra most commonly occurs. Analyses of the lipid composition in LDs and LD-coating proteins were compared in healthy early diestrus and pyometra-affected uteri.

“This work led to the current study investigating the expression patterns of LD-coating proteins involved in intracellular lipid metabolism, LD communications and signaling,” Dr. Walter says. “This allows for potential new therapeutic targets for drug recovery in canine pyometra.”

metra,” Dr. Von Dollen says. “From there, bacteria seize the opportunity to colonize and proliferate.”

The dynamics of the bitch’s cervix during her heat cycle likely contribute to the development of pyometra. “When a bitch is in heat, her cervix is open to allow sperm to gain access to the uterus. This provides a prime opportunity for bacteria to enter the uterus,” she explains. “Ideally, the immune system will attack these bacteria before they cause problems, which is why not every bitch develops pyometra. Once a bitch goes out of heat, the next phase is diestrus and the cervix is closed. If bacteria are trapped, it can set up a perfect storm for pyometra.”

*E. coli*, the most common bacteria cultured from the uterus of pyometra patients, is typically found in the intestines and vagina. The most vulnerable time to contract the illness is following estrus, or the heat stage, as the open cervix provides an opportunity for bacteria to ascend and colonize the uterus.

A disease in which the inside surface of the uterus develops small, raised cysts, CEH promotes

pyometra. “Bitches with CEH are much more at risk for pyometra, though not all will develop the disease,” Dr. Von Dollen says. “CEH creates cozy nooks and crannies in the uterus that are very attractive to bacteria.”

Although pyometra is not well understood, the urgency of promptly and aggressively treating bitches affected by the life-threatening condition is recognized. “Pyometra cases can change rapidly, so close attention by owners and veterinarians is important,” says Dr. Von Dollen. “Vigilant observation particularly during the two months following a bitch’s heat cycle can help detect subtle changes in attitude, appetite and behavior that can lead to early detection of pyometra and a greater chance of success with medical management.” ■

<sup>1</sup>Jitpean S, Ström-Holst B, Emanuelson U, et al. Outcome of Pyometra in Female Dogs and Predictors of Peritonitis and Prolonged Postoperative Hospitalization in Surgically Treated Cases. *BMC Veterinary Research*. 2014;10:6.

<sup>2</sup>Jena B, Rao S, Reddy KCS, et al. Physiological and Haematological Parameters of Bitches Affected with Pyometra. *Veterinary World*. 2013;6(7):409-412.

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**Purina and the AKC Canine Health Foundation have worked together since 1997 to support canine health research to benefit all dogs.**

