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Pyometra in a leopard (*Panthera pardus*), case report

Piometra en ejemplar de leopardo (*Panthera pardus*), reporte de caso

Hernández-Wolters Luana*^{ID}, Striedinger-Cardona Alejandro^{ID},
Rendón-Guizar Jesús**^{ID}



Zoológico La Aurora. 5ta calle Interior Finca La Aurora Zona 13 Ciudad de Guatemala, Guatemala.
*Responsible author: Hernández-Wolters Luana, **Author for correspondence: Rendón-Guizar Jesús. 5ta calle Interior Finca La Aurora Zona 13, Ciudad de Guatemala, Guatemala. C.P. 01013. E-mail: luana.wolters@gmail.com, jirendon@outlook.com

ABSTRACT

Pyometra complex is a hormonal, progesterone-dependent uterine pathology that is complicated with a bacterial infection. This condition has been observed in large felids living in captivity, usually those older than 10 years of age or with a medical history of progestogen-only contraceptive implant use. A 12-year-old female leopard with a medical history of reproductive diseases developed an open cervix pyometra that was treated with emergency oophorosalingohysterectomy and recovered successfully. Adequate prevention through individual housing, periodical reproductive evaluations, and prophylactic oophorosalingohysterectomy can reduce the incidence of pyometra in large felids living in captivity and improve their reproductive health and quality of life.

Keywords: Pyometra, large felids, leopard, *Panthera pardus*, oophorosalingohysterectomy.

RESUMEN

La piometra es una patología hormonal del útero, dependiente de la progesterona, que posteriormente cursa una complicación de infección bacteriana. Se ha observado este padecimiento en grandes felinos bajo cuidado humano, generalmente mayores de 10 años o con antecedentes de uso de progestágenos como contraceptivos. Una leoparda de 12 años con antecedentes de enfermedades reproductivas presentó piometra de cérvix abierto, la cual se trató quirúrgicamente de emergencia mediante oforosalingohisterectomía con una resolución satisfactoria. Un adecuado manejo preventivo con alojamiento individual de los ejemplares, evaluaciones reproductivas periódicas y oforosalingohisterectomía profiláctica puede disminuir la incidencia de la piometra en ejemplares de grandes felinos bajo cuidado humano y mejorar su salud reproductiva y calidad de vida.

Palabras clave: Piometra, grandes felinos, leopardo, *Panthera pardus*, oforosalingohisterectomía.

INTRODUCTION

Pyometra is a hormone-mediated pathological process secondary to bacterial infection, which produces an accumulation of purulent contents in the uterine lumen (McCain *et al.*, 2009). According to a study by Rainey *et al.* (2018), it is not common for pyometra cases to be reported in big cats such as tigers and lions, however, according to different reports the prevalence of this condition ranges from 5.5 to 17 %. This may be even higher in lions; this data is unknown in leopards and jaguars under human care. An important factor for



the pyometra presentation in these species is age, where there is a higher presentation in females 10 years of age or older (Rainey *et al.*, 2018).

Obtaining a diagnosis and appropriate treatment for pyometra in big cats are similar to those described for dogs and cats (McCain *et al.*, 2009). Treatment must be rapid and aggressive, since septicemia and endotoxemia can compromise the life of the animal. Even today there are still deaths due to this disease, although mortality decreases considerably if proper management is carried out (Silva & Loaiza, 2007).

In recent years, some studies on pyometra in big cats have been published, focusing mainly on tigers, jaguars and lions, but there are few publications on leopards. Due to the lack of emphasis on the pyometra prevention in big cats, known prophylactic measures are poorly applied in many zoos. This clinical case report seeks to outline the diagnostic approach, therapeutic protocol, and management of big cats under human care to prevent pyometra rather than treat it.

Case Presentation

A 12-year-old female melanistic leopard (*Panthera pardus*) weighing 30 kg is housed in an exhibit enclosure that she shares with a male specimen, being the only pair present at La Aurora Zoo, Guatemala City. The animals are housed in an exhibit of approximately 2400 m² in the open air, which has shaded and sunny areas; the floor is grass and earth, and there are logs on which they can climb and rest (Figure 1).



Figure 1. *Panthera pardus* in its exhibitor (Photograph taken by José Francisco Arriola Mansilla)



The enclosure has two 15 m² bedrooms, separated by a handling chute, where the animals are housed individually. The floor is made of cement, with wooden pallets, branches and a layer of hay as bedding; there is natural ventilation and sunlight is allowed to enter. Feeding is based on raw horse and chicken meat, supplemented with vitamins and minerals, which is administered once a day, and water is provided *ad libitum*.

The female leopard gestated on 3 occasions, the first in 2011, when she gave birth to 3 cubs; 2 were born alive without complications and the third was stillborn due to dystocia; as postpartum treatment a uterine lavage was performed. Subsequently, complications recurred at delivery requiring surgical intervention (cesarean section) for resolution.

The female leopard presented pyometra years later, which was adequately resolved with conservative treatment of three consecutive uterine lavages, consisting of the administration of 100 mL of 0.9 % saline solution with a dilution of 60 mg of gentamicin (Vaz *et al.*, 2021). Since that event, the female presented reproductive problems and inability to become pregnant.

Clinical findings and interpretation

The presence of bloody-purulent fluid in the form of spots on the bedroom floor and on the vulva of the female leopard was reported, in addition to hyporexia and polydipsia, findings that were corroborated by the veterinarian in charge. The following day, she was anesthetized with xylazine (Xilaphorte 10 %) at 1.4 mg/kg, ketamine (Ket-A-100) at 5 mg/kg and midazolam (Dormicum) at 0.2 mg/kg intramuscularly and transferred to the zoo hospital, where she was administered maintenance inhaled anesthesia between 2.5 to 3 % with isoflurane (Baxter) for a complete physical examination; he was rehydrated by intravenous fluid therapy with 0.9 % sodium chloride (Finlay), blood (saphenous vein) and urine samples were taken by cystocentesis, and imaging studies were performed.

Laboratory and imaging tests

Hemogram showed leukocytosis of 28.8 x 10³ cells/ μ L (IDEXX VetAutoread[®]), while blood chemistry showed an increase in total protein 11.7 mg/dL and globulin 8.9 g/dL as well as a decrease in cholesterol 32 mg/dL and alanine aminotransferase < 10 U/L (IDEXX Catalyst One[®]).

For the ultrasound, an EDAN DUS 60 VET[®] was used (Figure 2), in which abundant anechoic content was observed in the lumen of both uterine horns and a thickening of the uterine wall, thus ruling out the probability of early gestation.

The bladder was observed with mild distention and normal sized walls. A urine sample was taken by means of ultrasound-guided cystocentesis for a general urine test (IDEXX VetLab UA[®]), which showed no alterations. With this information, the presence of an open neck pyometra was confirmed.



Figure 2. Ultrasound of the uterus, showing uterine horn with thickened walls and anechoic content in the lumen

Treatment and Evolution

For resolution of the pyometra, the female leopard was subjected to an emergency open oforosalingohysterectomy (OSH) (Figure 3), in which multiple adhesions were observed in the bladder, so peritoneal lavage was performed. The surgery lasted approximately three hours, there were no complications during anesthetic recovery. The final weight of the uterus was 0.97 kg, with thickened walls and bloody-purulent contents (Figure 4). A bacteriological culture of uterine secretion was performed, using blood agar (Scharlau) and MacConkey, once the colonies developed, we proceeded to the identification of genus and species, for which the following tests were used: TSI (Triple Sugar Iron Agar), LIA (Lysine Iron Agar), SIM (Sulfide Indole Motility), coagulase, catalase, hemolysis, NaCl 6.5 %, bile esculin, PYR (Pyrrolidonyl Arylamidase), arabinose and tellurite, resulting in the identification of *Enterococcus faecalis* (Hervé & Porte, 2007; Díaz *et al.*, 2013).



Figure 3. Uterus with contents during OSH surgical procedure

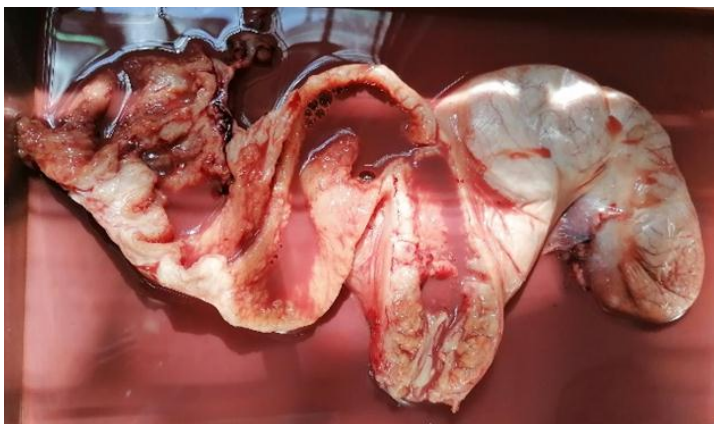


Figure 4. Uterus with incision in the body and uterine horn. Thickened walls and bloody-purulent contents are observed

As post-surgical treatment, enrofloxacin (Enroflox 150) was administered orally at a dose of 10 mg/kg every 24 h for 7 days and meloxicam (Meloxicam generico) orally at a dose of 0.2 mg/kg for 3 days with a progressive decrease of 50 % of the dose. The leopard was active and responsive, ingesting fluids and food adequately; in the following days the wound was dry. The result of the treatment was successful as the pyometra was adequately resolved.

DISCUSSION

Pyometra is a hormone-mediated pathological process secondary to bacterial infection, which produces an accumulation of purulent contents inside the uterus ([McCain et al., 2009](#)). It is a common condition in unspayed female dogs and cats and the most clinically



important uterine pathology in small species (Silva & Loaiza, 2007), but this condition has also been observed in big cats under human care (McCain *et al.*, 2009).

Pyometra is most prevalent in middle-aged to older females (Silva & Loaiza, 2007); in big cats it occurs mainly in specimens older than ten years. It is known that exogenous progestogens such as melengestrol acetate, commonly used in contraceptive implants in captive big cats, can increase the prevalence of cystic endometrial hyperplasia (CEH) and predisposition to pyometra (Rainey *et al.*, 2018).

The main bacteria causing pyometra in big cats is *Escherichia coli*, followed by *Pseudomona aureginosa* (Rainey *et al.*, 2018). However, the bacterium isolated in this clinical case: *Enterococcus faecalis*, is a gram-positive commensal bacterium of the gastrointestinal tract that acts as an opportunistic pathogen of systemic diseases and is a common cause of urinary tract infections in cats (Kukanich & Lubbers, 2015). Therefore, it is possible that the bacteria entered the uterus through urinary, fecal, or coital contamination.

Pyometra usually occurs during parturition, when the uterus is under the influence of progesterone (P4) due to the generation of the corpus luteum. On numerous occasions pyometra occurs as a secondary process to a CEH, which is due to an abnormal response of the uterus to prolonged or repeated exposure or high P4 values in the endometrium, whereby cyst formation, edematization and thickening of the uterine glandular tissue is induced (Silva & Loaiza 2007; McCain *et al.*, 2009; Duarte *et al.*, 2014). P4 suppresses the leukocyte response of the uterus, stimulates the secretory activity of endometrial glands and decreases myometrial contraction, facilitating fluid retention and thus creating a suitable environment for bacterial proliferation (Duarte *et al.*, 2014; Reynoso *et al.*, 2020). Estrogen (E2) causes dilatation of the cervix increasing the likelihood that normal vaginal microbiota will enter the uterus and proliferate. For this reason, the CEH-pyometra complex is considered to be a progesterone-dependent hormonal pathology of the uterus that subsequently presents with a complication of bacterial infection (Silva & Loaiza, 2007).

According to its clinical signs, it can be classified as open cervix or closed cervix pyometra. The former refers to the presence of vulvar discharge, being absent in closed cervix pyometra (Silva & Loaiza, 2007), in which its diagnosis is more difficult. The most common type in big cats is open cervix pyometra (Rainey *et al.*, 2018).

Some of the clinical signs that may occur in small species include lethargy, anorexia, dehydration, polyuria, polydipsia, abdominal distention and pain, emesis, hyperthermia or hypothermia, among others (Silva & Loaiza, 2007; Zuluaga, 2018). However, clinical signs are dependent on the state of permeability of the uterus, being able to generate septicemia and endotoxemia (Silva & Loaiza, 2007). The clinical signs of pyometra in big cats are similar to those described above, with some differences. Thus, in them the identification of pyometra is done mainly by the observation of vulvar discharge, being this the most



common sign, followed by lethargy, hyperthermia, anorexia and infrequently dehydration and emesis.

Pyometra can cause renal, cardiac and digestive complications and can even lead to death, mainly due to uremic syndrome (Reynoso *et al.*, 2020). Although polydipsia in conjunction with polyuria was observed in the present case, it is frequently present in small species, they are not common signs in big cats, although its presence could be underdiagnosed due to the management and type of housing under human care (McCain *et al.*, 2009; Rainey *et al.*, 2018).

Diagnosis of pyometra is based on clinical history, presenting signs, and complementary examinations that help corroborate suspicions. Hematologic and urine tests allow knowing if the patient has metabolic abnormalities caused by septicemia and to evaluate renal function, which is of great importance in felines.

In the hemogram the common findings are anemia and leukocytosis at the expense of neutrophilia and monocytosis. Leukopenia may be observed as a result of septicemia or uterine sequestration of neutrophils. Blood chemistry commonly shows hyperproteinemia, hyperglobulinemia and azotemia and in lower incidence hypoalbuminemia, increased alanine aminotransferase and alkaline phosphatase and hyper- or hypoglycemia. Urinalysis can demonstrate the presence of proteinuria, hematuria and bacterial growth (Silva & Loaiza, 2007; McCain *et al.*, 2009; Reynoso *et al.*, 2020). Ultrasonography is one of the best methods to detect uterine problems (Fornazari *et al.*, 2011) and it is the method of choice for the diagnosis and confirmation of pyometra in big cats (McCain *et al.*, 2009). In it, the distended uterus can be observed with a hypoechoic or anechoic image suggestive of fluid in its lumen, usually with thickening of the walls and displacement of surrounding organs (Murer *et al.*, 2015; Reynoso *et al.*, 2020).

Treatment must be carried out quickly and aggressively, since septicemia or endotoxemia can occur rapidly, compromising the life of the specimen (Silva & Loaiza, 2007). There are two types of treatment for pyometra: pharmacological and surgical. Pharmacological treatment consists of administration of fluid therapy, antibiotherapy and luteolytic drugs when the female is genetically and reproductively valuable, with open cervix pyometra and the infection is not advanced; however, this treatment usually has a high percentage of recurrences (Zuluaga, 2018). The most efficient and treatment of choice for both types of pyometra is OSH (Reynoso *et al.*, 2020).

This procedure should be accompanied by a correct pre-surgical fluid therapy for the correction of azotemia, since the prognosis worsens if this is not treated; likewise, broad-spectrum antibiotherapy should be administered immediately while the results of the bacterial culture and antibiogram are obtained (Silva & Loaiza, 2007).



In recent years, the use of minimally invasive surgery has been recorded, such as laparoscopic OSH, which allows the visualization of internal organs, the performance of a smaller incision and therefore the reduction of soft tissue trauma, post-surgical pain and the possibility of surgical site infection, thus having a better recovery and a faster reintegration of the specimen to the collection compared to conventional OSH (Rainey *et al.*, 2018).

The prognosis of surgical treatment for pyometra is favorable, since recovery is rapid and recurrence is null due to the complete removal of the uterus, resulting in a high possibility of survival of the specimen (Silva & Loaiza, 2007; Zuluaga, 2018). In pharmacological treatment, the prognosis depends directly on the uterine involvement, the extension of the infection and the duration of the treatment, leading to a high risk of recurrence (Silva & Loaiza, 2007).

Pyometra should not be ruled out with only normal hematologic and abdominal radiographic findings, so regular reproductive evaluations, including complete physical examinations and ultrasounds, are important for the prevention of pyometra. Prophylactic OSH should also be considered in captive big cat females of advanced age, outside of reproductive age, or those for which reproduction is not desired (McCain *et al.*, 2009).

Based on the evidence, it is recommended not to use exogenous P4 implants for contraception in big cats as it predisposes them to pyometra and other side effects, and better contraceptive techniques exist (McCain *et al.*, 2009).

Recently, deslorelin (gonadotropin-releasing hormone agonist) implants have been used as contraceptives as it inhibits the production of gonadal and pituitary hormones, thus suppressing the reproductive system. It is known that when deslorelin is applied, the initial effect causes stimulation of the reproductive system, which can cause estrus and ovulation. This first effect must be suppressed, otherwise it can result in a constant increase of progesterone post ovulation causing mammary and uterine pathologies. Therefore, the Association of Zoos and Aquariums (AZA) recommends the suppression of the stimulatory phase by administering megestrol acetate one week before and after the application of the implant. In addition to this, it is estimated that, in big cats, the efficacy of deslorelin implant may be of a minimum time of 6-12 months, since the exact duration and reversion time is unknown, being this variable and not controllable. Therefore, caution is required in its management and further investigation of its effects in different species (AZA, 2016^a).

Felines are induced ovulators and the endometrium is exposed to P4 only after copulation. It has been shown that ovulation in leopards does not require copulation, but does require some stimulation, such as the presence of other females, and that this does not occur when they are housed separately (McCain *et al.*, 2009).



AZA, in its manuals for the care of jaguars and tigers recommends that, in captivity, animals that in the wild are solitary should be housed individually and only be introduced to their mates during the reproductive season in case reproduction is desired, as this improves the reproductive capacity and the benefit of the specimens ([AZA, 2016^a](#); [AZA, 2016^b](#)).

CONCLUSION

Laboratory and imaging tests should be performed together to reach a definitive diagnosis and establish an adequate and precise treatment that allows the correct resolution of the clinical case. Non-surgical treatments such as the administration of antibiotics, hormones or the performance of uterine lavage did not prove to be effective, since the leopard relapsed with reproductive problems.

Oophorosalingohysterectomy proved to be the definitive treatment for pyometra since, due to the removal of the uterus, there is no recurrence of pyometra.

RECOMMENDATIONS

Individually housing non gregarious big cat females under human care reduces copulation, and thus exposure to P4, and thus prevents ovulation, thus constituting a viable and effective method of pyometra prevention. This, together with periodic reproductive evaluations, avoids the loss of reproductive capacity of genetically important females in breeding and conservation programs and therefore should be considered as part of the routine management of non-gregarious big cats in captivity. In the same way, consider carrying out preventive OSH in older females to reduce reproductive diseases and their potentially fatal repercussions or those that affect the quality of life. These measures help prevent reproductive pathologies, improve reproduction and contribute to the welfare of the animal.

The use of deslorelin as a contraceptive is favorable, however, its use should be at discretion since it can generate reproductive pathologies and requires constant monitoring of the female at the end of the half-life of the drug, therefore, it cannot be established as a safe method of prevention until there is more research on its use in the species.

Available information about pyometra and evidence about the effectiveness of its prevention methods in big cats is scarce. Therefore, an in-depth study of the prevalence and prevention of pyometra in captive big cats is needed.



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