

Pyometra in Female Dogs: Review

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Abstract: Pyometra is a common post-oestral syndrome in bitches. Most commonly it resulted from hormonal fluctuation experienced by intact female bitches. In pyometra, the uterus reacts abnormally to this hormonal fluctuation, resulting in bacterial infection within the uterus. Classical treatment consists of either ovariectomy or medical intervention based on the clinical stability of the bitch and discussion with the patient's owner concerning the future potential risks on reproduction ability. Surgical uterine drainage and lavage *via* direct trans-cervical catheterization using a 5 % povidone-iodine in saline solutions is an option of treatment. Closed cervical pyometra is most risked than open in causing uterine rupture and systemic illness. Ovariectomy is the best treatment for those dogs not deemed for future reproduction by their owners. Ovariectomy is more advantageous than medical treatment by being both curative and preventive for recurrence of pyometra. The most common post-operative complications are wound infection, fistulous tracts, local swelling and even hemorrhage.

Key words: Bitch • Ovariectomy • Pyometra

INTRODUCTION

The word pyometra comes from two words; pyo which means pus and metro which means uterus. Pyometra is a pus filled post-oestral (diestral) syndrome in adult intact bitch associated with a variety of clinical and pathological manifestations of genital and multi systemic disease [1]. Pyometra is most commonly associated with polydipsia, polyuria, abdominal distention, vomiting, poor appetite weight loss and anemia. Depending on the severity of disease the bitch may appear healthy, be slightly off, or ill due to the absorption of bacterial toxin in blood stream [2]. Pyometra can be either open or closed based on whether the cervix is opened or closed. A purulent vaginal discharge may, however, be the only symptom in some cases of open pyometra. It appears that the degree of the openness or closeness of the cervix dictates the severity of clinical sign to large extent

Canine pyometra is life- threatening intra-uterine disease may be caused by: hormone-receptor relationship Some bacteria ascending through vagina during proestrus and estrus, inducing the disease during met estrus by acting on progesterone primed endometrium directly via toxin production, or indirectly by resulting inflammatory mediators [3].

There is a clear association between cystic endometrial hyperplasia and pyometra. CEH is a progressive degenerative process and, is generally accepted to be the initiating lesion and contributes to failure to shed normally transient uterine infection by compromising the uterine environment and /or local defense mechanism.

The most infectious bacteria that cause pyometra is: *E. coli*, beta-hemolytic streptococci, *P. multocida*, *Klebsiella* species etc. These bacteria enter through vagina when the bitches are in estrus and cervix is opened. But for the rest of time the cervix remain closed forming a tight barrier between the uterus and the external environment [4].

The uterus has the potent defense mechanism for cleaning bacterial invasion and bacterial growth. This Includes:- local immune response with antibody, white blood cells, production of fluids by lining of the uterus and contraction of uterus thus, pyometra occur when these defense mechanisms are compromised [1].

The other key factor for developments of pyometra is hormonal changes. During heat period the hormone progesterone elevated to case the uterine lining to thicken to accept the incoming pregnancy.

If pregnancy is not occurred the uterus may continue to thicken the lining by secreting the mucus like fluid

which is the ideal environment for bacterial multiplications. At the same time the elevated progesterone interfere with the contraction and relaxation to expel the uterine debris and fluids accumulated.

Generally, since pyometra is the most life threatening syndrome in intact bitch treatments should be conducted either medical for open or surgical treatment for closed Pyometra [1]

Literature Review: Pyometra is a common reproductive disease with up to 25 per cent of all entire female dogs developing the disorder before they reach 10 years of age [5] and, is most commonly treated by ovariohysterectomy following stabilization of the patient using IV fluid therapy and broad-spectrum antibiotics. However, numerous medical treatments have been proposed for both open and closed pyometra with good success and preservation of future fertility. Since ovariohysterectomy offers a definitive, rapid resolution of clinical symptoms, prevention of the condition's recurrence and of future neoplasia of the female reproductive tract, medical management is likely to be reserved for the treatment of bitches with high breeding value [1].

Traditionally, pyometra has been considered the end stage of cystic endometrial hyperplasia (CEH), whereby optimal conditions within the uterus allow opportunistic ascending pathogens to establish infection. However, it has been suggested that CEH and pyometra may be separate disease entities since all dogs develop CEH with age, but not necessarily pyometra. Similarly, pyometra may occur without evidence of CEH in younger animals. It has been suggested that bacteria may be the initiating factor, stimulating uterine wall hypertrophy and hyperplasia towards the end of estrus leading to infection [3].

It has been suggested that pyometra is a condition of middle aged and older dogs. However, pyometra has been reported in dogs as young as 4 months old and as old as 16 years. Some studies revealed that prevalence is 15.2% in non spayed female dogs over the age of 4 and the average age of onset was about 9 to 10 years. And it is 2% in bitches more than 10 years old [6].

Pyometra can occur in any breed of dogs. Dog Breeds which are thought to be predisposed to pyometra include Rough-Coated Collies, Rottweiler and Miniature schnauzers etc.

Breeds thought to have a decreased predisposition to pyometra include Drevers, German Shepherds, Dachshunds and Swedish Hounds. Not all studies have

confirmed a breed disposition. Meanwhile, previous pregnancy has been reported to be protective in some dog breeds but not in all [6].

Despite modern treatment routines, the mortality rate due to pyometra is still approximately 4 percent.

Myocardial injury secondary to endotoxemia, inflammation, disseminated bacterial infection, or infraction is suspected to be a contributing factors in unexpected deaths

Medical and surgical treatments are the best treatment options using either PGF₂ alpha or ovariohysterectomy. The most common complications are: wound infection, fistulous tracts, local swelling and even hemorrhage [7].

Etiology: Each time a female dog undergoes estrus cycle usually about twice a year and hormonal changes associated with pregnancy - whether the bitch becomes pregnant or not. The changes in the uterus that occur with each season make infection more likely with age. A very common organism called E. coli [8] found in dog faeces usually causes the infection. Most commonly cases of pyometra occur 4- 6 wks. after the first estrus.

Some Factors Are:

Breed: Breeds thought to be predisposed to pyometra include rough-coated collies; Rottweiler's, miniature schnauzers etc and those breeds thought to have a decreased predisposition to pyometra include Drevers, German shepherds, dachshunds and Swedish Hounds [5]

Age: Pyometra occurs at any age after the first estrus

Parity: Previously it was suggested that null parity, abnormal estrous cycle and pseudo pregnancy disease have no association. But recent literature has suggested that there is no association between pseudo pregnancy and abnormal estrus cycle. However, there is a modest relationship between null parity and pyometra.

Stages of Estrous Cycle: Most bitches present to pyometra within 8 weeks of last estrus however, it also may occur at any stage of estrous cycle or during pregnancy.

Hormone: Progesterone has a role in initiating the pathogenesis of CEH - Pyometra complex. Endometrial hyperplasia that resulted into CEH caused by progesterone is more pronounced when it has been

primed with estrogen. Thus administration of estrogen when progesterone level is high may predispose bitches to pyometra.

Estrogen keeps the cervix relaxed for longer period in the luteal phase and also enhancing the stimulatory effect of the progesterone on uterus [9].

Clinical Manifestation: The clinical signs associated with pyometra typically appear 4-6 weeks after the completion of estrus. Most of the clinical signs are not specific for pyometra, including lethargy, depression, pyrexia, anorexia, vomiting, diarrhea, polydipsia and polyuria. A serosanguineous to mucopurulent vaginal discharge can be seen if the cervix is open. Vaginal discharge may be the only clinical finding in some patients [2].

In patients with closed-cervix pyometra, vaginal discharge may not be present. Dogs with closed pyometra are often more seriously ill at the time of diagnosis than those with open- pyometra. A closed cervix inhibits the elimination of the infectious uterine material, delaying the recognition of illness and increasing the likelihood of complications such as septicemia, endotoxemia (most commonly associated with *E. coli* infection) and septic peritonitis [1].

Bacterial contamination in cases of septic peritonitis may be the result of uterine rupture, translocation of bacteria across the diseased uterine wall, or, less likely, oviduct leakage. More severely patients may present with signs of shock, dehydration, or collapse.

Early signs that may be noticed are: Licking back end more than normal, Off color, Off food and Drinking more water than normal (and will probably urinate more)

These signs will progress to: Pus discharge (yellow/red/brown discharge) from vulva and May have a distended abdomen

If left untreated signs will worsen to the point of dehydration, collapse and death from septic shock.

Pathogenesis: The physiologic changes responsible for predisposing a uterus to pyometra are not completely understood. The vagina is not a sterile environment. Many bacteria types have been cultured from the normal vaginal vault, including *Escherichia coli* and *Staphylococcus*, *Streptococcus*, *Klebsiella*, *Pasteurella*, *Pseudomonas* and *Proteus* species.

Same bacteria are commonly cultured from the uterine of patients with pyometra which suggests that bacteria ascending from the dog's vaginal vault are the likely source of uterine infection in most patients developing pyometra.

The bacteria isolated from the uterus were genetically similar to those found in the patients' gastrointestinal tracts, demonstrating that bacteria within a patient's own body and not exogenous bacteria are responsible for infection

Primary urinary tract infections and the hematogenous spread of bacteria from genitourinary sites have been suggested to be less frequent sources of infection than ascending infections from the vagina however; bacterial contamination of the uterus does not appear to be solely responsible for the development of pyometra. Vaginal bacteria will normally cross the cervix into the uterus when the cervix is open (proestrus and estrus), yet pyometra did not routinely develop [10].

Studies performed in the 1950s by Sweden suggested that cystic endometrial hyperplasia is a prerequisite for the development of pyometra in a bitch. Cystic endometrial hyperplasia develops in most intact female dogs as goes aged. It is caused by chronic recurrent exposure of the endometrial lining to progesterone produced by the corpus luteum during diestrus. Binding to uterine receptors, progesterone induces endometrial gland proliferation, stimulates endometrial gland secretions, decreases myometrial contractility and induces closure of the cervix [11].

Progesterone has also been shown to interfere with immune function within the uterus, possibly increasing its susceptibility to bacterial infection.

Progesterone's effect on the endometrium is cumulative from reproductive cycle to reproductive cycle [12]

The studies suggested that accumulating uterine secretions, prominent endometrial gland crypts and immune suppression caused by progesterone stimulation during di-estrus make the uterus an ideal environment for bacterial proliferation leading to pyometra. This condition has been subsequently termed cystic endometrial hyperplasia-pyometra complex [13].

Not all dogs with pyometra have cystic endometrial hyperplasia. Other factors can play a role in the development of pyometra. Studies have demonstrated that irritants within the uterus, such as foreign material that has passed through the cervix or even a subclinical bacterial infection, may induce endometrial inflammation and hyperplasia. These endometrial changes contribute to a favorable environment for bacterial colonization or proliferation, leading to pyometra [13].

The propensity of some pathogenic bacteria, such as *E. coli*, to attach to the endometrium may explain why

some bitches without cystic endometrial hyperplasia develop pyometra. Exogenous hormones can also prime the uterus for infection.

Pyometra has been noted to occur after the exogenous administration of estrogen used to inhibit pregnancy after a miss mating. Exogenous estrogen enhances the uterus sensitivity of to endogenous progesterone.

Diagnosis: A history of recent estrus, unspaying and typical clinical signs, especially vaginal discharge, should raise the suspicion for pyometra. In patients lacking vaginal discharge, the diagnosis can be more challenging.

An enlarged uterus may be palpated within the abdomen; however, aggressive attempts at palpation should be avoided to prevent inadvertent uterine rupture. Other potential causes of vaginal discharge or uterine enlargement, including pregnancy, estrus, hydrometra, mucometra, vaginitis, neoplasia and uterine torsion, need to be considered as differential diagnosis.

Laboratory findings in patients with pyometra are not specific for pyometra and frequently reflect the presence of inflammation and secondary metabolic disturbances. The results of a complete blood count will often demonstrate a neutrophilia with a regenerative left shift however; a normal white blood cell count or even a neutropenia with a degenerative left shift may be identified in animals with endotoxemia and high white blood cell count [2].

Canine pyometra can be diagnosed using ultrasonography if cervix is open and if closed radiography [14]. Ultrasonographically, a fluid filled organ with variable wall thickness and proliferative change can be visualized. A lateral abdominal radiography can be utilized to identify a sausage-like fluid filled tubular organ located between descending colon and urinary bladder [14].

Dogs that are seen early in the disease may have a slight vaginal discharge and show no other signs of illness. However, most dogs with pyometra are not seen until later in the illness. A very ill female dog drinking an increased amount of water and has not been sterilized is always suspected of having pyometra. This is especially true if there is a vaginal discharge or painful, enlarged abdomen [14].

Dogs with pyometra have a marked elevation of the white blood cell count and often have an elevation of globulins (a type of protein produced by the immune system) in the blood. The specific gravity of the urine is very low due to the toxic effects of the bacteria on the kidneys [15] However, all of these abnormalities may be present in any dog with a major bacterial infection.

Treatment: Both surgical and medical management options are available to treat patients with pyometra and both carry associated risks. The decision to pursue medical vs. surgical management should be based on the clinical stability of the bitch as well as on discussions with the patient's owner concerning the associated risks of treatment and the patient's reproductive value and potential. Bitches with closed-cervix pyometra are at higher risk for uterine rupture and systemic illness [16].

Dogs presenting with clinical signs of illness or shock should be appropriately stabilized before direct treatment of the uterine disease is attempted. The goals of patient stabilization are to restore normal perfusion of the tissues, correct electrolyte and glucose imbalances and initiate treatment of infection [17].

Clinically ill patients will benefit from intravenous (IV) fluid therapy and the administration of parenteral antibiotics. In patients not responding to IV support and medical treatment, surgical excision of the infected uterus may be required to remove the source of infection and achieve a successful recovery. The mortality rate associated with pyometra is about 5% and most of these deaths are due to secondary endotoxemia and shock [17].

Bacterial culture and antibiotic susceptibility testing of the uterine contents and urine are recommended in all patients with pyometra to confirm the effectiveness of empiric antibiotic therapy.

Samples for bacterial culture are most commonly taken from the surgically excised uterus. In those patients undergoing medical management, representative bacterial cultures may be retrieved from the cranial vagina by using double-guarded swabs. It should be noted that bacteria grown from cranial vaginal cultures may not be the same as those present in the uterus.

The retrieval of samples for bacterial culture and cytological evaluation through transcervical endoscopy has also been reported.

All patients being treated for pyometra should immediately begin empiric bactericidal antibiotic therapy. Amoxicillin-clavulanate or a combination of penicillin and a fluoroquinolone, is a good antibiotic choice based on historical bacterial causes of uterine infection [18].

The suitability of the empiric antibiotic therapy would then be confirmed by the antibiotic susceptibility results reported from the patient's original bacterial cultures. Antibiotic therapy should be continued for 7 to 14 days beyond resolution of the patient's pyometra based on physical examination, laboratory and Ultrasonographic findings [18].

In general, the goal of treatment is:

- Preventing Progesterone effect either by inducing luteolysis or preventing binding to its receptor.
- Promotion of cervical relaxation in closed pyometra to allow expulsion of uterine content by using either Prostaglandin F₂-alpha or progesterone-receptor antagonist
- Induction of uterine contraction and emptying the content
- Inhibiting of bacterial growth and development through the use of antibiotics.
- Facilitating uterine regeneration by prolonging anestrus.

Medical Treatment

Open Pyometra: Both dogs with open-cervix or closed-pyometra can be successfully treated with medical management. Medical management of pyometra is best performed in patients of appropriate breeding age that are reproductively valuable and free of immediate life-threatening illness, including septicemia, endotoxemia, or organ dysfunction [19].

The initial goal of medical management is to reduce the progesterone stimulation of the uterus, which contributes to making the uterus a favorable environment for bacterial infection. This goal can be achieved by administering medications that promote regression of the progesterone-producing corpus luteum or that block progesterone receptors in the uterus [19].

Prostaglandin: Prostaglandin F₂-alpha is the most commonly used medication to medically manage Pyometra in dogs [20]. Prostaglandins induce regression of the corpus luteum (luteolysis) through numerous mechanisms, including constriction of blood vessels responsible for oxygen delivery. As the corpus luteum regress, progesterone production drops. The reduction in progesterone concentrations promotes relaxation (opening) of the cervix, allowing the uterine contents to escape.

Prostaglandins also directly stimulate myometrium contraction, thereby promoting removal of the infected uterine contents.

Although not documented, uterine rupture could occur theoretically if intense myometrial contractions precede cervical relaxation.

Dogs treated with injectable prostaglandins frequently demonstrate adverse effects such as abdominal discomfort, vomiting, defecation, urination, tachycardia, restlessness, anxiety, fever, hyper salivation, or panting [21].

Adverse effects are dose-dependent and cholinergic-like and result from the systemic stimulatory effects of prostaglandins on smooth muscle elsewhere in the body. These adverse effects will usually occur within minutes of administration and can persist for up to an hour or more afterward.

The prevalence and severity of adverse effects usually decrease with repeated prostaglandin treatments.

An earlier study suggested that intravaginal administration of prostaglandin may be associated with a reduction of adverse effects. Walking the patient immediately after prostaglandin administration for 20 to 60 minutes can be beneficial in minimizing the severity of these adverse effects. If the adverse effects are persistent or severe, pretreatment should be given. Rarely, more serious adverse effects, including cardiac arrhythmias and anaphylactic shock have been reported [22].

Both natural and synthetic prostaglandin formulations have been used to successfully treat pyometra. Their dosages and administration frequencies vary according to the selected protocol (0.1-0.25 mg/kg sc, SID OR BID for 3-5 days). It is important to adhere closely to the recommended prostaglandin product dosing regimen as prostaglandins have narrow safety margins and severe adverse effects can be expected when excessive doses are given.

Synthetic prostaglandin formulations, such as cloprostenol, appear to induce fewer adverse effects because of increased specificity for the uterine smooth muscle.

In a report of 163 dogs with open-cervix pyometra treated medically with prostaglandins alone, 153 dogs responded favorably.

Dopamine Agonist: Dopamine agonists have been used in combination with prostaglandins to treat pyometra. Dopamine agonists act by inhibiting prolactin production by the pituitary gland. Prolactin is luteotrophic. Repeated administration of prolactin inhibitors will induce a rapid drop in plasma progesterone concentrations. Thus, a reduction in prolactin concentrations in the blood would be expected to have a synergistic effect with prostaglandins for promoting regression of the corpus luteum [23].

Dopamine agonists' cabergoline and bromocriptine have been administered for this purpose. Cabergoline is often preferred over bromocriptine because it usually has fewer adverse effects. In one study, the combination of cloprostenol and cabergoline was successful in treating 21 of 22 patients with open cervix pyometra.

In another study involving both open and closed cervical cases, 24 of 29 patients were successfully treated with this combination [23].

Progesterone Receptor Antagonist: Progesterone receptor antagonists, such as, aglepreston have also been evaluated for the treatment of pyometra. These products competitively bind to progesterone receptors in the uterus, preventing endogenous progesterone from exerting its effect. However, progesterone-receptor antagonists do not directly stimulate the myometrium to contract and expel the uterine contents, their use as a sole therapeutic agent for treating pyometra may be limited [24].

B. Closed Cervix Pyometra: It is a series condition that requires OHE but the administration of aglipreston during diestrus in bitch will cause the opening of the cervical os with consequent emptying of the uterine content. Following the treatment with the dose of 10 mg/ kg aglipreston administered on days 1, 2 and 8 in 15 bitches with closed pyometra, opening of the cervix was reported to occur after 26±13 hours in all treated animal. Although the success rate is 20% following up treatment of the same dose of antiprogesterin at day 14 and 28 associated with prostaglandin treatment is 90% success rate. If the bitch is with closed pyometra, liver and kidney disease medical do not give this [24].

Surgical Treatments: depending of the age of animal being considered, with fertility generally being highest in younger dogs.

The usual treatment of pyometra is OHE and the most important aspect of this treatment is its rapidity and fast recovery. Broad spectrum antibiotics is also administered at the time of anesthetic induction and continued for 7 to 10 days. After surgery, corrective therapy for fluid deficits, acidosis and sepsis is started and continued as needed [25].

Bitches are often septic and not in shock and rapidly spaying to remove the infected organ. In sick animal, surgery is not proposed for more than a few hours because the diseased uterus continues to contribute bacteremia and septicemia and if renal function is impaired before surgery 20% mannitol is administered (0.25-0.5 g/kg) intravenously [26].

Recent Trends in Management of Pyometra

Surgical Uterine Drainage and Lavage

Pre-surgical Therapy: Before surgery is done sever

shock should be stabilized using fluid therapy and high dose of prednisolone sodium succinate at 10 mg/kg i.v. Corticosteroid therapy has been used in varies dose for sepsis and related cause.

As soon as diagnosis is made, bitch should be treated with 20 mg/kg clavulanate potentiated amoxicillin and Gentamycin at 4mg/kg (BID). Flunixinmeglumin should be also administered at 2mg/kg (SID) in conjunction with ringers lactate infusion at rate above maintenance the surgical flushing commenced within 48 hours of diagnosis [25].

Surgical Method: The flushing medium selected is a 50:50 mixture of Betadine (povidone iodine 100mg/ml) and normal saline to substitute a 5% beta dine-saline mixture.

The bitch premedicated with atropine sulphate (0.5). Induction of anesthesia is achieved by using sodium thiopentone and maintenance was achieved by halothane gas inhalation.

The perinal area washed using water and antiseptic soap and the bitch is prepared as for a laparotomy.

In addition to the surgeon and surgical assistant another third assistance is required to manipulate the irrigation pipette and flushing medium (non-sterile assistant).

A standard midline incision of abdomen is made to allow exteriorization of the uterine body and localization of both cervix and vagina [1].

The non -sterile assistance inserts the sterile vaginoscope in to vagina. Sterile bovine artificial insemination pipette with syringe was introduced via the lumen of vagino-scope and advance cranially until the surgeon able to locate it through vaginal wall then the none sterile surgeon remove the vagino-scope from the vagina.

The surgeon locates the tip of the pipette with one hand and simultaneously stabilizes the cervix with the other hand.

The non-sterile assistant carefully advances the pipette cranially until the pipette is close proximity to the cervix.

The surgeon then manipulates the cervical opening onto the tip of the pipette and slides the cervix over the pipette.

The tip of the pipette is palpable in the uterine body and visible when pushed against the uterine wall. The non- sterile assistance then attach 50m syringe to the end of the pipette.

Depending on the viscosity of the exudates, the assistance could apply suction and aspirate the content

from the uterus. The surgical assistance is required to occlude the utero-tubal junction of both horns using gentle digital pressure while the sterile assistant infused the flushed medium in the uterus.

The maximum volume infused in to the uterus at any one time depends on size of the uterus and varied between 20 and 50 ml. With the assistance occluding the utero-tubal junction, the surgeon massaged the uterine wall of, mixing the exudates and the flushing medium.

The non-sterile assistant thereafter aspirated the contents of uterus back in to the syringe prior to emptying the syringe, re-filling and injecting more flushing medium in to the uterus and repeat it until that part of the uterus is evacuated.

At the end of the procedure the remaining uterus content will milked caudally to escape from the uterus by the combination of aspiration via. the pipette lumen or manually along the outer diameter of the pipette in the vagina.

The pipette could be removed from the cervix and an irrigation of the vagina is performed using the flushing media to remove any pus accumulated in the vagina [1].

surgical treatment (ovariohysterectomy)

Ovariohysterectomy is surgical removal of ovary and uterus mainly for stabilization of bitch.

Pre- Surgical Patient Preparation: After examining the bitch is fit to the OHE then the animal must be restricted from food and water. Withhold food for 12-24 hours and water for 6-12 hours and then prepare surgical site

Hair Removal - Done at induction, before the animal is moved to a surgery table.

Using a No. 40 clipper blade, the hair is first clipped along the same direction of hair growth and then against the direction of hair growth. Clippers should be used gently, parallel to the skin. Hair is clipped in an area extending at least 10 cm in all directions from the planned incision. Loose hair is thoroughly removed with a vacuum before transferring the patient from the induction area to a surgery table [27].

Positioning:

Before beginning the skin preparation be sure:

- The patient is stable in dorsal recumbence with the head toward the anesthetic machine and the head is resting comfortably on the table
- Anesthetic tubing is properly connected and secure Patient is at an a
- Warming disks are placed if the animal is small or very young.

Warming devices should be placed under a towel or other covering and should never be placed in direct contact with the patient as serious burns can result. Limbs are tied to help stabilize the patient.

In large, deep-chested dogs, it may help to cross the forelimbs, securing each tie-down to the opposite side of the table. Be careful not to over-tighten ties as nerve damage or other complications can result.

Skin Preparation: As soon as the patient is positioned on the table, thorough skin prep is completed:

Scrub skin with chlorhexidine scrub from the preparation tray.

Rinse with water containing dilute chlorhexidine solution (pale blue solution).

Repeat both steps a total of 3 times after all gross debris have been removed.

Begin each scrub in the center of the scrubbed area, over the planned incision site and scrub in a 'Bulls eye' pattern toward the periphery, never going back to the center with the same gauze Sponge.

The skin preparation should be thorough but gentle to avoid unnecessary skin trauma.

The final application of chlorhexidine solution is allowed to remain on the skin.

It is important that the skin preparation is started as soon as the animal is on the surgery table to allow for maximum scrub and contact time between antimicrobials and the skin.

After skin preparation is complete, finish securing legs and make final adjustments in lighting.

Open pack and place blade and suture on sterile field after the patient is positioned and scrubbed.

Preparation of Surgical Team: Both the primary surgeon and assistants must be sterilely gowned and glove for all surgeries.

The primary surgeon should be scrubbing in patient is anesthetized and should be prepared to begin draping the animal as soon as the final positioning and patient preparation is complete.

The assistant surgeon will stay with the patient to help as needed with induction, transfer, Positioning and prep, then scrub in and join the surgeon

Draping - With the animal positioned and the skin prepared, the animal is draped:

Drapes are in the surgery packs and are not fenestrated. The drape is fenestrated after it is placed on the patient.

There should be a continuous sterile field from the cranial end of the drape to the instrument tray (Which is placed behind the patient). On large dogs a second drape may be required to cover chest or feet.

Drapes are placed in one motion and then either used, removed or more drapes added to achieve the desired effect. Once the drape is placed, it should not be repositioned toward the surgical site as this will carry contaminants onto the prepared skin.

Anesthesia: OHE is done under GA, which includes a combination of ketamine (5-10mg/kg i.v) and xylazine (0.5-1.0mg/kg i.m) or ketamine and diazepam (1-2mg/kg i.m) and anticholinergic drug atropine sulphate 0.045mg/kg sc or i.m. given to check salivation [27].

Surgical Site: Middle mid ventral incision (for small breed) and oblique left flank incision (for large breed) are used.

Surgical Procedure: The length of the midline abdominal incision is based on the size of bitch. The distance between the umbilicus and the pubis are divided in to three then incision is made cranial third because the ovaries are more difficult to exteriorize than the uterine body. If the uterus is distended the incision is lengthened. The flank incision is not preferred in pyometra because the entire uterine body is difficult to remove in this approach.

The right uterine horn is located by the means of ovariohysterectomy hook or the index finger. The clamp is placed on the proper ligament of the ovary and is used to retract the ovary while the suspensory ligament is stretched which is more difficult to exteriorize than the uterine body.

The right uterine horn is then legated with one or two suture before it is cut.

Three clamps are placed on the uterine body just cranial to the cervix and then the Uterine body is severed between the proximal and middle clamps.

In case of pyometra, the severed ends of the uterine body should invert towards the cervix end, either by Cushing or the Lambert suture pattern to remove the peritonitis.

The uterine arteries are individually ligated caudal to the most caudal clamp. The caudal clamp is removed and then the uterus is ligated in the groove that remains [27].

The uterine pedicle is grasped with the small hemostat above the clamp and is removed then the Pedicle is inspected for bleeding after all the pedicle is gently replaced in to the abdomen and the hemostat is removed. Antibiotics and fluid therapy is given for 5-7 days.

Post Operative Management: Post-operative medication should be given to reduce secondary complication and to relief the animal from pain. Intravenous fluid and antibiotic

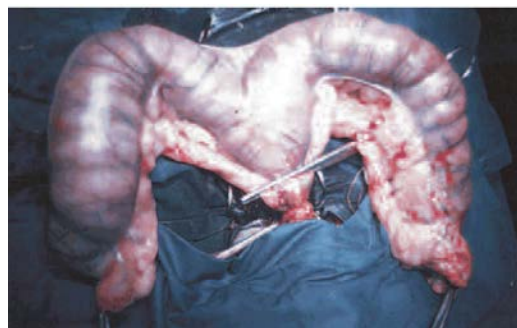


Fig. 1: Pyometra- A severely pus-distended uterus

Table 1: Comparison of surgical and medical treatment[28]

Treatment	OHE	Medical
Occurrence	Closed cervix	Open
Disease condition	Presence of systemic disease	Bitch is in a good general condition
Side effect	No side effect after spaying	Predisposed
Ultrasonographic result	Endometrial glandular cyst are demonstrated	Not demonstrated
Group	Elderly bitch, younger bitch , intended for breeding	Non breeding bitch

should be recommended to improve the health of the animal. The home care should be also guaranteed until the stitches are removed in 10 to 14 days and the incision line should also be inspected by the owner for the sign of redness, discharge, swelling and pain.

Complications: The most common complications are: - hemorrhage, recurrent estrus, uterine stump infection, ligation of the ureter, urinary incontinence, weight gain, eunuchoid syndrome and uterine ovarian stump granuloma [28].

CONCLUSIONS AND RECOMMENDATIONS

Pyometra is abscessed, pus-filled infected uterus. Pyometra needs to be treated or death ensues. Spaying dog removes the risk of developing pyometra. Pyometra (pus in the uterus) usually happens in middle aged dogs and is more common in older dogs. Most pathogenic agents also contribute much for the occurrence of pyometra some of such pathogens are like *E. coli*, klebsella and etc.

The main advantage of OHE over medical management is both curative and preventive for recurrence of pyometra. After surgery, wound infections, fistulas, local swelling and hemorrhage are the expected complications.

Based on the above conclusions the following recommendations are mentioned:

- Educating the owners about the potential risk of Pyometra, its prevention and managements.
- Some special referrals should build in our country to handle the problem surgically.
- Enough professionals should train with their special professions like anesthetist, surgeon and gynecologist.
- Before surgery discussion with the owners about the outcome after surgery is important.
- After surgery, advise the owners how to manage the patients postoperatively.
- Enough drugs should be available.
- If patients are not responsive to medical treatment immediately apply surgery.
- Diagnosing machines like x-ray and ultrasonography should be available.

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