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Vaginitis in the bitch

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1. Introduction

In my thesis I will investigate the problem of vaginitis in the female dog and the consequences resulting from the inflammation. During closer studying I will look at characteristics of canine vaginitis in both young and adult animals. This will include information about the aetiology, clinical features, diagnostic methods and treatment. I know that the main reason for vaginitis are anatomical abnormalities and other predisposing factors. Due to this, I will focus on how to detect the underlying causes and thereby find good methods that can decrease the incidence of canine vaginitis.

I have chosen this topic as I have a special interest for the obstetrics subject and would like to work with small animals in the future. Due to the fact that vaginitis may result in reproductive problems I find it interesting to find out if there are ways to diminish the occurrence of the illness and find the best way for treatment to avoid reoccurrence of the problem after treatment. My work is based on information found in books and articles. I have worked on it as a literature review.

1.1 Goals

My goals in this thesis are to find out the answers to the questions I have about the topic. What is the most common cause of vaginitis in the bitch? Is there any breed or age predisposition? Does it occur more often in spayed or in intact dogs? What can be done for prevention? How extensive are the possible reproductive losses? What will be the best treatment option in accordance to the age?

2. Physiology of the vagina

The female reproductive system consist of the ovaries, oviducts, uterus, cervix and vagina, which is referred to as the internal reproductive organs, and the external genitalia which is the vulva and clitoris. Outer portion of the vagina has stratified squamous epithelium. Around the time of estrus this epithelium undergoes keratinization (Sjaastad et al, 2010). The vagina is a muscular and tubular part of the female genital tract. It is considered as the cranial part of the female copulatory organ. Together with the vestibule, its continuation, the vagina serves as a birth canal and as a passage for excretion of urine. The vagina is located in a median position in the pelvic cavity between the rectum dorsally and bladder ventrally. It is long and has a thin wall. Special for the dog compared to other domestic animals, is that the vaginal epithelium responds to hormonal level in a more pronounced way. Due to this, it is possible to take smears from the vagina and estimate where in the cycle the dog is. This is a helpful tool for veterinarians when they are estimating the optimum time for breeding. The caudal portion of the female copulatory organ, the vestibule, extend from the external urethral opening to the external vulva and combines the reproductive and urinary functions. The vulva is formed by two two labia (König & Liebich, 2009).

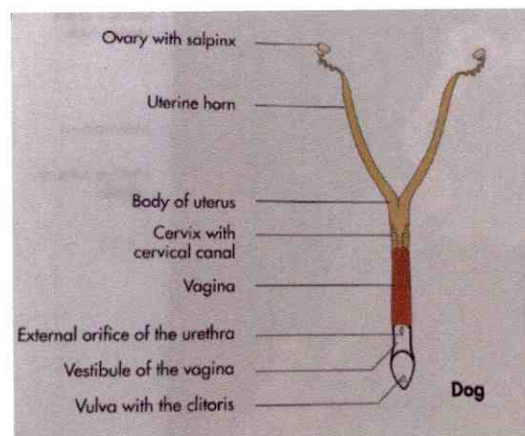


Figure 1 The female reproductive system (König & Liebich, 2009)

Functions of the female reproductive system is to produce oocytes and provide a proper environment for growth and nutrition after fertilization of a mature oocyte. In addition to producing oocytes the female gonads produce female sex hormones. Depending on where in the cycle the dog, oestrogen or progesterone is the dominant hormone. These hormones regulate the development of the reproductive organs and induce sexual behaviour (Reece, 2009).

3. Normal vaginal microflora

When we go in a caudal direction, from the cervix to the vestibule more and more bacteria can be found. The vagina is not a sterile environment. Normally the cervix is a barrier and will be closed, this prevents bacterial invasion into the uterus from the vagina. During proestrus and estrus, when the cervix is relaxed to let sperm enter the uterus, bacteria found in the vagina easily can enter the uterus. Pyometra is an inflammatory condition of the uterus. Bacterial contamination of the uterus will not alone be the responsible for this condition, other uterine factors will predispose for pyometra to occur as it does not routinely develop every time bacteria flows into the uterus from the vagina. From samples obtained from the vagina and uterus from sexually mature bitches during different stage of estrous cycle, aerobic and anaerobic bacteria were identified. Amount of bacteria found was higher in dogs in estrus than in dogs in anestrus, pregnancy and post partum. Most commonly bacteria isolated from the vagina are Bacteroidaceae, Streptococci, Pasteurella spp and mycoplasma. From the uterus Staphylococci and Mycoplasma were more frequently isolated. Even if the uterus had bacteria present, there were in most cases no pathological findings. When bacteria from the vagina enters the uterus, it will in most cases not result in a uterine infection (Baba et al, 1983).

According to an other article I read, samples were taken from uterus, cervix and vagina in different stages of the reproductive cycle. The bitches used in this study were all confirmed free from uterine diseases. Sampling of the uterus per vaginum in dogs is hard due to the elongated, narrowing vagina and the special anatomy of the cervix, which opens not centrally but dorsally at the cranial end of the vagina. The sampling was taken trans cervical in a sedated dog or carried out immediately post mortem in normal bitches. Bacteria were always found in the uterus of dogs during proestrus and estrus. During the other stages of the reproductive cycle, bacteria were rarely found. The bacteria found in the uterus were always the same bacteria as found in the vagina and cervix. In approximately 50% of the cases, bacteria were found only in vagina and cervix and not in the uterus. The average number of isolates were significantly greater in proestrus and estrus than other stages of the reproductive cycle. The most commonly bacteria isolated from the uterus are, in correct order of frequency, Escherichia coli, Haemophilus species, alpha-haemolytic Streptococci, Corynebacterium species, Streptococcus canis, Alcaligenes faecalis, Bacteroides species, Pasteurella species and Proteus mirabilis. No mycoplasma was cultured from the samples obtained from the uterus. This article indicates that during pro-estrus and estrus, the uterus of a normal bitch will

have a microflora similar to that of the vagina and cervix (Watts et al, 1996).

3.1 Stages of estrous cycle

For identification of the stage of the canine estrous cycle, vaginal cytology can be used. The samples obtained have to be stained and examined under microscope for determination. Neutrophils, bacteria, red blood cells and type of epithelial cells present have to be identified. Epithelial cells that can be found are parabasal cells, small and large intermediate cells and superficial cells. They are differentiated based on size and the characteristic of nucleus and cytoplasm. From this information together with evaluation clinical signs, it is possible to differentiate between proestrus, estrus, diestrus and anestrus (Kahn,2010).

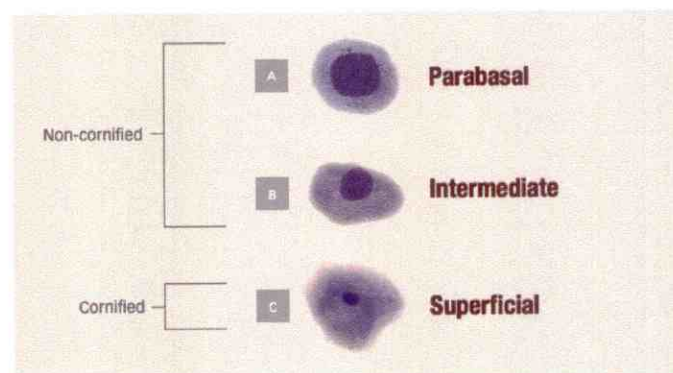


Figure 2 Epithelial cells found throughout the estrus cycle (Davidson, 2015)

In proestrus all the different types of epithelial cells are observed together with neutrophils, red blood cells and mucus. The closer to estrus, the epithelial cells increasingly approach terminal differentiation, superficial cells, and the amount of neutrophils gradually decrease. Typical for estrus is that more than 90% of the epithelial cells are superficial cells. No mucus will be in the background. Amount of bacteria is high and the neutrophils which were present in proestrus disappear. In diestrus, more than 80% of the epithelial cells are parabasal and intermediate cells. Number of bacteria and neutrophils in this stage variate, but it will in most cases be less than in proestrus. Sometimes it can be hard to differentiate proestrus and diestrus. In anestrus the predominating epithelial cells are parabasal and intermediate cells. Neutrophils and bacteria are rarely seen in this stage of the cycle (Kahn, 2010).

4. Vaginitis

Vaginitis is an inflammation of the vagina. It may occur in prepubertal or mature bitches (intact or spayed). Vulvar discharge is the most common clinical sign. The discharge varies from mucoid to mucopurulent. In addition to discharge, frequent urination, licking of vulva and attraction of males may be seen. In case of vaginitis there is usually no sign of systemic illness and the hemogram and biochemical profile are normal. Vaginitis may or may not have an infectious cause (Kahn, 2010).

In adults a wide range of causes can result in vaginitis. It may be caused due to viral infections (eg. Canine herpes virus 1- CHV-1), bacterial infections(eg. *Brucella canis*), urinary tract diseases, vaginal foreign body, systemic disease, stress, congenital or acquired malformations of the reproductive system or it could be idiopathic. Malformations of the reproductive tract is often an underlying cause of vaginitis. Vaginal atrophy, vestibular stenosis, hyperplasia or enlargement of clitoris are some examples (Lluch & Mas, 2014). Vaginitis is classified as primary if it is due to the infection with canine herpesvirus type 1 (CHV-1) and *Brucella canis*. It is important to identify the underlying cause of the disease and correct this. If it is not corrected, reoccurrence is common. Canine vaginitis may occur at any age and is not shown to have any breed predisposition. There are different forms of vaginitis depending on age. These are juvenile or puppy vaginitis and adult-onset vaginitis (Sant`Anna et al, 2012). The diagnostic tests for these two types of vaginitis are the same, but a complete-work up is often not necessary in case of juvenile vaginitis. This is because this type of vaginitis usually has mild clinical signs and in most cases heals on its own when the dogs enter proestrus/estrus (Kustritz, 2008).

Vaginitis is considered as a rather rare disease in female adult dogs. Despite this, it is important to have the proper knowledge about the illness. This is due to if the vaginitis goes uncorrected for a longer period of time, this may lead to an ascending uterine infection which in worst case could result in infertility (Sant`Anna et al, 2012). When making the diagnosis it is important to remember that both several physiological and pathological conditions have similar clinical signs as vaginitis (Kustritz, 2006). In female dogs the vagina is long compared to size of the animal. Because of this it is often difficult to properly examine the vagina (Nelson & Couto, 2009).

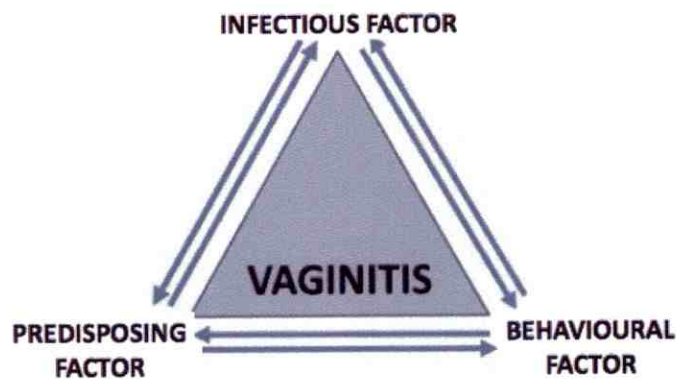


Figure 3 Factors resulting in vaginitis (Lluch & Mas, 2014)

4.1. Bacterial vaginitis

Bacterial vaginitis can be caused by *Enterobacter* spp. or microorganisms from the lower urinary tract, such as *Streptococcus* spp., *Staphylococcus* spp., *Escherichia coli*, *Proteus* spp., *Pseudomonas aeruginosa* and *Pasteurella* spp.. Bacterial vaginitis is often a secondary to other problems like hormonal disorders, nutritional deficiencies, antibiotics used prophylactic or improper hygienic conditions that predisposes to enhance bacterial proliferation. These bacterial infections can result in local infections in the vagina and cause damage to the reproductive system, lead to infertility and result in embryonic death or abortion. Typical clinical signs of bacterial vaginitis are mucopurulent or purulent vulvar discharge, pollakiuria, licking the vagina and attraction of males independent of the the estrous cycle stage. Usually there is no systemic involvement (Sant`Anna et al, 2012). In some cases of bacterial infections, it is hard to say if it was the vaginitis that caused the urinary tract infection or the urinary tract infection that caused vaginitis (Kustritz, 2008).

4.1.1. *B. canis*

Vaginitis may also be caused by *Brucella canis* and the infection is considered as primary. It is important in the differential diagnosis of dogs with lesions and/or vaginal secretions and a history of reproductive problems (Sant`Anna et al, 2012). *Brucella canis* is a small, coccoid-rod, Gram-negative bacteria. This organism is a facultative intracellular pathogen. Dogs are the only definite hosts. The bacteria is zoonotic and humans can occasionally get infected resulting in a mild systemic disease. Infection with *Brucella canis* has been reported in dogs in the USA, UK, Japan and Central and South America. Due to its low virulence, which result in mild or asymptomatic infections, the distribution may be more extensive than currently recognized (Quinn et al, 2016). *Brucella canis* mainly infects the reproductive organs of

sexually mature females and males. This can result in abortions, stillbirths, epididymitis, orchitis and sperm abnormalities. The main route of transmission is venereal. *Brucella canis* occurs in the fetus, placenta, fetal fluids and vaginal discharge after an abortion or stillbirth. After an abortion the bacteria can persist in vaginal discharges for weeks. The bacteria may also be found in high concentrations in the dogs' semen for weeks or even months after infection (CFSPH, 2012). The most typical clinical sign of *B.canis* infection is miscarriage during the final third of gestation. Fetal death or resorption during first third of pregnancy may also occur. After the abortion a vaginal discharge is commonly observed, lasting around 1-6 weeks (Sant' Anna et al, 2012).

Only a few cases of *B.canis* infections have been reported in humans. Due to this the clinical signs in humans are based mainly on the symptoms caused by other *Brucella* species. Some infections with *Brucella* spp. result in symptoms while other infections are asymptomatic. In case of symptomatic cases the symptom vary greatly. In typical cases it starts with an acute febrile illness with non specific flu signs such as fever, headache, chills, malaise, myalgia and general discomfort and pain. Some patients recovers spontaneously while others develop persistent symptoms. As *Brucella canis* is zoonotic and antibiotics can not reliably eliminate the infection, euthanasia of infected animals are usually recommended in kennels and also an option in pets (CFSPH, 2012).

4.2. Viral vaginitis

Canine herpesvirus type I (CHV-I) can result in a fatal systemic infection in new-born pups and in older dogs it may result in vaginitis. After recovery from clinical disease the animal remains a life long carrier as the virus lay latent, in the lumbosacral ganglion, until reactivation. This is typical for alpha-herpes virus. Only canids (dogs, wolves and coyotes) are known to be susceptible (Kahn, 2010). Canine herpesvirus type 1 occurs in canine populations worldwide. Serological surveys indicate a high prevalence of infection in the general canine population and is estimated to be greater than 40% according to two European studies (Morresey, 2004).

Death due to CHV infections usually occurs in puppies when they are around 1-3 weeks. This is the time they maintain body temperature below 37 °C and the virus replicates more successfully at this temperature. Due to this it is important to try and keep the puppies warm to hinder the fast viral replication. The onset is sudden and death occurs within 24 hours,

sometimes before onset of symptoms. In case of clinical signs, lethargy, decreased suckling, diarrhoea, nasal discharge, erythematous rash may be observed. Rarely oral or genital vesicles are seen (Kahn, 2010). Adults are usually asymptomatic. The virus remains latent in the body and can be reactivated when the host immunity is compromised by certain stressful situations such as pregnancy and immunosuppressive therapy. Clinical signs that may be observed in adults are diffuse papulo-vesicular lesions on the vaginal mucosa. Some days later these lesions will become firm and they will regress completely within 14-18 days. CHV-1 may result in reproductive failure and is characterised by infertility due to early embryonic death, fetal resorption, abortion of developed and ossified foetuses, stillbirths, underdeveloped newborns or neonatal death (Sant'Anna et al, 2012).

Herpesvirus is a virus that is relatively fragile outside the cell. Therefore the opportunities for transmission is limited. Routes of transmission mostly involves transfer from parent to offspring, sexual contact or direct oro-nasal contact between infected and susceptible animal. Infected dogs shed the virus in the nasal mucosa in the acute phase of infection. For prevention you should vaccinate the pregnant bitch. In addition you should provide adequate temperature for the puppies to maintain normothermia to aid in the prevention of the rapid replication of the virus (Morresey, 2004).

4.3. Vaginal foreign body

Vaginitis caused by a vaginal foreign body is rare in dogs. According to articles I have read, only six reports have been published so far. Grass awns commonly causes foreign body diseases in small animals resulting in abscesses and pyogranulomas. Usually these foreign bodies are found in the ear, oral cavity, eyes and subcutaneous tissue. Not much is known about grass awns in the genital tract. A case report carried out by Veterinary Science Department in Parma, Italy, reveals a case of vaginitis caused by grass awn. A six-year old intact female Lagotto Romagnolo presented with a history of purulent vaginal discharge for two days together with clinical signs such as fever, lethargy, polyuria polydipsia and abdominal pain. On ultrasound a vaginal foreign body, a grass awn, was observed. After performing an ovariohysterectomy the presence of the grass awn was confirmed. The bitch fully recovered after the removal of foreign body. A differential diagnosis for acute vaginal vaginitis should therefore include retention of vaginal foreign bodies, despite its rare occurrence (Fabbi et al, 2014).

4.4 Urinary tract diseases

Vaginitis may be caused by the accumulation of urine or discharge in the vagina. Retained urine increases the risk for bacterial overgrowth. Urine accumulation can be due to urinary incontinence. An other reason for urine accumulation could be stenosis of the vaginal vestibule junction. Tumours and foreign bodies also needs to be kept in mind when trying to find the underlying causes as this may disrupt the urine flow and vaginal secretions (Sant`Anna et al, 2012).

Urinary incontinence is the the loss of bladder control. Micturition is a complex process controlled by the muscles of the bladder and sphincter mechanism and the modulatory system in the central and peripheral nervous system. When the dogs loses the control of the bladder there will be an involuntary leakage of urine. This result in accumulation of urine and can enhance overgrowth of bacteria in the area. It can either be a congenital or an acquired condition (Silverman & Long, 2000). The urinary incontinence connected to vaginitis in dogs is thought to be by urethral sphincter mechanism incompetence(USMI), earlier called oestrogen responsive urinary incontinence (Kustritz, 2008).

This is a problem that is frequently seen in veterinary practice. Urinary sphincter mechanism incompetence is the most common micturition disorder seen in mature, female, neutered dogs. The pathomechanism is not completely understood (Reichler & Hubler, 2014) . Factors leading to USMI include reduced urethral tone, a shorter urethral length, an intrapelvic bladder, weak supporting mechanism in the lower urinary tract, large body size , breed , neutering, hormones and obesity. Dobermans, Old English Sheepdogs, Rottweilers, Weimaraners, Springer Spaniels and Irish Setter are large dog breeds that are at higher risk of developing UI. It occurs much more frequently in females but both sexes can be affected. Urinary incontinence is more frequently seen in spayed bitches. This is seems to be due to the decreased amount of circulating oestrogens. Spayed females are thought to be eight percentage more likely to develop urinary incontinence compared to intact bitches. Less common reasons for congenital UI are ectopic ureters, bladder hypoplasia, intersexuality and congenital neurological disorders. Other reasons for acquired UI are prostate disease in males, bladder neoplasia, ureterovaginal fistula, acquired neurological conditions, overflow incontinence associated with chronic retention and detrusor hyperactivity/instability (Hill, 2011).

5. Forms of vaginitis

There are recognized two types of vaginitis in the bitch depending on the age of onset. These are named juvenile or puppy vaginitis and adult-onset vaginitis. Juvenile vaginitis is seen in dogs that have not undergone puberty yet, commonly younger than one year. Most of the dogs with juvenile vaginitis don't show or only show minor symptoms of the disease. In case of the the adult-onset vaginitis the onset of clinical signs is variable and more prominent than in puppies. If presence of other systemic diseases, like diabetes mellitus, the symptoms of vaginitis are exacerbated. Vaginitis is seen more frequently in spayed bitches than in intact ones. Clinical signs and treatment of vaginitis depend on age and aetiology of vaginitis (Kustritz, 2008).

5.1 Juvenile vaginitis

40-52% of reported cases of vaginitis are of juvenile vaginitis (Sant' Anna et al, 2012). It is usually an incidental finding during a routine physical examination of prepubertal female dogs less than one year. A clear to white sticky odourless discharge gluing the vulvar lips together can be seen. In case of urinary tract diseases or abnormal vaginal anatomy with secondary infection, juvenile vaginitis may consist of inflammation. This condition is often idiopathic (Kustritz, 2010). For the puppies only having non haemorrhagic vulvar discharge with the absence of systemic involvement there is no need for further diagnostic tests and they do not require treatment. However, the area should be kept clean to avoid secondary skin problems. This condition will dissolve spontaneously when they enter proestrus/estrus (Ucar et al, 2011).

There are different opinions about spaying of animals presenting vaginitis that have not entered estrous cycle. In young bitches presenting vaginitis the relationship of spaying or estrous cycle has to be further investigated. It may be advantageous to induce a pharmacological estrus in castrated juvenile females with severe or chronic vaginitis. This can be achieved by oral administration of the diethylstilbestrol every 24 hours for 7 days. The treatment should be continued for two days after onset of bleeding. It should be taken into consideration that there is no guarantee that this treatment will resolve the disease and weigh them up against negative side effects caused by intake of estrogen. The possible side effects of the use estrogen can in rare cases be bone marrow aplasia, diabetes mellitus and thromboembolic disorders, which can result in death of the dogs (Sant' Anna et al, 2012).

A clinical article about five cases of puppy vaginitis in India was published in 2012. In this article the appearance of the external genitalia of puppy, stated as "innie" and "outie" vulva, have shown to have correlation with the onset of vaginitis in puppies. Five puppies in an age range from 3- 5 months showed clinical signs of sticky, cloudy, vaginal discharge for two days in addition frequent licking of the vulva was observed. Further clinical examination revealed a swollen vulva and skin fold around the vulva. This made the vulva look like it was "turning" inwards, therefore referred to as "innie" vulva. One of the breeders mentioned in this article had both puppies with "innie" and "outie" vulva. Only the puppies with "innie" vulva had complaints with discharge. In this article it is suggested to examine the external genitalia before selecting a puppy for breeding purposes. To prevent future generations to get an "innie" vulva, and in that way possible problems with puppy vaginitis, they encourage spaying after onset of the first heat (Shiju et al, 2012).

5.2 Adult onset vaginitis

Vaginitis in adults are much more commonly seen in spayed bitches than intact ones. The age of onset variate greatly. No breed predisposition is seen for this type of disorder (Kustritz, 2008). 70% of vaginitis in adult bitches is either due to secondary predisposing factors or due to the decrease of estrogen in spayed females. In 35% of adult females with vaginitis, anatomical abnormalities of the reproductive tract is identified. The abnormalities are commonly vulvar anomalies, hypertrophy of the clitoris, vaginal stenosis due to connective tissue formation in the vagina or vaginal atresia. In adult-onset vaginitis factors that result in accumulation of urine or other discharge from the vagina may be a common cause for vaginitis. Clinical signs depend on the aetiology and therefore variate (Sant` Anna et al, 2012). Common clinical sign in adult-onset vaginitis is mucoid to purulent vulvar discharge. Additionally vulvar licking, pollakiuria and urinary incontinence are typical complaints. (Kustritz, 2008). Due to the presence of bacteria that are normal in the micro flora of the vagina it is often difficult to determine if it were bacteria that actually caused the disease (Sant` Anna et al, 2012). With proper treatment and elimination of predisposing factor, the prognosis is favourable. Cases resulting from anatomical abnormalities are those that are the most difficult to treat (Lluch & Mas, 2014).

6. Diagnosis

When diagnosing vaginitis it is important to remember that both several physiological and pathological conditions have similar clinical signs as vaginitis. Clinical symptoms like vulvar discharge and vulvar licking may be seen in physiological conditions such as estrus, whelping and post partum lochia. It may also be present in pathological conditions like vaginal neoplasia, stump pyometra, ovarian remnant syndrome, vaginal foreign body, urinary tract infection, urinary incontinence or a systemic condition. The diagnostic tests for puppy and adult onset vaginitis are the same, but in case of mild juvenile vaginitis which often is self-limiting, a complete work-up is usually not required. Juvenile vaginitis will in most cases spontaneously resolve after first estrus, unless other underlying factors are present that will lead to constant recurrence of the vaginitis. A more detailed examination of the vagina of the puppy will then take place. Tests used for diagnostic procedures are cytological examination of vaginal epithelial cells and vaginal discharge, vaginal bacterial culture, vaginoscopy, digital examination, urinalysis and bacterial culturing (Kustritz, 2008).

If possible, evaluation of both the vagina and urinary tract should be carried out to localize the primary cause. Dogs may require sedation during inspection as it can be painful due to irritation of the area or in case of dogs with small vaginal vault it can be difficult to carry out the examination properly in an awake state. The vaginal mucosa should under normal conditions be the same colour as normal oral mucosa. Inflamed mucosa will have a dark pink to dark red colour (Kustritz, 2010).

When performing the test for making a diagnosis it is important to think about the order you examine the dog and take test samples. Erythema may be induced when collecting cytological and culture samples. Because of this many will think that vaginoscopy should be carried out first. When performing a vaginoscopy lubrication is needed to introduce the instrument. The lubrication will change the milieu in the vagina and during introduction of the vaginoscope cell or debris may be pushed into the vaginal vault, which may result in a false result of other diagnostic tests. Order of diagnostic methods vary from person to person, but it is important to keep in mind the changes that can be induced by the different methods to prevent making fast conclusions and wrong diagnosis (Kustritz, 2008).

6.1. Vaginal cytology

Vaginal cytology is a rapid and inexpensive diagnostic method. A moistened cotton-tipped swab is inserted at the dorsal commissure of the vulva to obtain a sample from the cranial vagina. The swab should be inserted to about half of its length and advanced horizontally above the clitoral fossa, rotated and pulled out. Afterwards the swab is rolled onto a glass slide, air-dried and stained. It is then examined further under the microscope (Davidson, 2015). No negative side effects have been reported from performing a vaginal cytology. In case the cotton falls off the applicator stick, the cotton can easily be guided out by a digital palpation of the vagina (Kustritz, 2006a).



Figure 4 Vaginal cytology (Davidson, 2015)

When carrying out a vaginal cytology the most common interpretations are degree of cornification and characteristics of the discharge. In female dogs with vaginitis non cornified epithelial cells, mucoid debris and polymorphonuclear cells are seen (Kustritz, 2010). It is also used to determine in which stage of the estrous cycle a bitch is in. The estrous cycle is divided into 4 phases: proestrus, estrus, diestrus and anestrus. Its important for breeders to know when the dog comes into heat, estrus, to properly plan mating. The dog breeder can go to the veterinary clinic and then get the result right away as it is a fast and non complicated method. During estrus superficial cells predominate and in most bitches the cells undergo cornification. Greater than half of the cells appear to have no nucleus. When examining the characteristic of discharge, it is classified as sanguinous, mucoid or purulent. From this classification you can rule out several disorders and thereby narrow the range of possible diagnosis. During vaginal cytology the swab inserted do not need to be sterile, as it is the type of cell and discharge we are interested in. In contrast to vaginal bacterial culture where there should be as little contamination as possible to not interfere with the result (Kustritz, 2006a).

<u>Characteristics of discharge</u>	<u>Rule-outs</u>
Sanguinous	Normal estrous cycle – Proestrus, estrus Coagulopathy – VWD, haemophilia, anticoagulant rodenticide poisoning Vaginal neoplasia Blood cell parasitism - Babesia, Erlichia Subinvolution of placental sides
Mucoid	Late pregnancy Urinary tract disease Vaginitis Parturition – post partum(lochia)
Purulent	Pyometra Vaginitis

Table 1: Rule outs for vulvar discharge in female dogs (Root Kustritz, 2006a)

6.2 Vaginoscopy

Vaginoscope is a useful instrument in the diagnostic procedure for evaluating vestibule and vaginal disorders in female dogs. Both rigid and flexible endoscope can be used to ease the veterinarian's ability to detect diseases due to improved illumination, magnification and proper vaginal distention. To prevent irritation and trauma of the inspected area it is important that the size of the scope is suitable for the size of the patient (Lulich, 2006). The length of the canine vagina is relatively long, depending on the breed. The length is about 10-14 cm in a beagle and in a Newfoundland it can be up to 29 cm! With good hygienic conditions and the use of a proper technique during vaginoscopy, complications like haemorrhages, lacerations and introduction of infections are rare. Findings during vaginoscopy are compared to the normal anatomical features of the vagina. The endoscopic appearance varies greatly depending on the stage of estrous cycle (Nelson & Couto, 2009). Vaginoscopy can also be done by a vaginal speculum or an otoscope, which mostly is simple and easy to perform. The disadvantage with this technique is that the vagina will not be distended and the visualisation during examination is limited. (Lulich, 2016).

In some cases, especially in young bitches, it is not possible to carry out vaginal examination due to a too narrow vulva and/or narrow junction between vestibulum and vagina. (Rijnberk

& Van Sluijs, 2009). Endoscopic vaginoscopy is performed in anesthetized dogs. First the perineal area is cleaned and disinfected. To minimize faecal contamination from the rectum during the vaginoscopic examination, the dogs are positioned in dorsal recumbence (Lulich, 2016). The endoscope has to be lubricated before introducing it to ease the insertion and prevent trauma. It can either be lubricated with warm saline solution or with a sterile, water-soluble lubricant. To avoid the clitoris and clitoral fossa, as this is extremely painful, the endoscope must be inserted in a dorsal direction through the dorsal commissure of the vagina. The vestibulovaginal junction is narrow and you feel an increased resistance here. After passing through the vestibulovaginal junction the angle of the speculum is changed to be more parallel with the spine (Nelson & Couto, 2009).

Vaginal septa and strictures are vaginal anomalies described in dogs. These are abnormalities that result from abnormal foetal development of the female reproductive tract. Vaginal septum is a congenital partition of the vagina, it may be either transverse or longitudinal (Kustritz, 2008). The vaginal mucosa should under normal conditions have the same color as healthy oral mucous membranes, rosy-pink color. Vaginitis cannot be diagnosed without evidence of vaginal inflammation (Kustritz, 2010).

6.3. Digital vaginal examination

Digital examination of the vagina should be carried out in all dogs showing symptoms of vaginitis. By palpation vaginal anatomical abnormalities can be detected. This is important to diagnose due to the fact that vaginal abnormalities often are an underlying cause of adult-onset vaginitis. In 88% of cases, vaginal strictures or septa can be identified by digital vaginal examination (Kustritz, 2008). Other things that can be noticed during palpation of the vagina are neoplasia, lacerations, abnormal shape of pelvic inlet, presence of fetus in pelvic canal and foreign bodies. When carrying out digital examination of the vagina a glove is worn and antiseptic lubrication is put on the finger that is used for examination. The finger must be introduced via the dorsal commissure through the vestibulum and to the vagina. This is only possible when the transition from vestibulum to vagina is not too narrow (Rijnberk & Van Sluijs, 2009).

6.4 Vaginal bacterial culture

Infectious vaginitis is considered to be caused secondary due to presence of an underlying cause of inflammation. The bacteria most commonly cultured from dogs with vaginitis are

bacteria that are present in the normal bacteria flora of the vagina. "Normal" bacteria may become pathogenic if the vaginal defence is altered. When interpreting culture results, it is important to keep in mind that the vagina is not sterile. A significant bacterial culture is determined with moderate to heavy growth of one or two bacterial species (Kustritz, 2008).

A guarded culture instrument is used to ensure contamination to be as little as possible when taking a culture sample from the anterior vagina. Both culturing of bacteria and sensitivity tests should be performed. Sensitivity test are important for us so that we know which antibiotics to be used to fight the infection. In this table commonly isolated bacteria from vagina of normal healthy bitches and bitches with vaginitis is listed. The organisms are listed in accordance to the frequency in which they are cultured from normal or affected bitches. Mycoplasma and Ureaplasma organisms are also often present as it is a part of the normal flora of the canine genitourinary tract. Due to the fact that culturing of these bacteria are difficult, it is not easy for the laboratories to provide quantitative results and concluding a positive result (Kustritz, 2006a).

Aerobic bacteria isolated from <u>normal</u> bitches	Aerobic bacterial isolated from bitches <u>with</u> <u>vaginitis</u>
<p>E.coli Sterptococcus canis Pasteurella multocida Staphylococcus aureus Streptococcus sp. beta-hemolytic Streptococcus alpha-hemolytic Streptococcus Bacillus sp. Proteus mirabilis Staphylococcus intermedius Staphylococcus sp.</p>	<p>E.coli Streptococcus canis Staphylococcus intermedius beta-hemolytic Streptococcus Staphylococcus aureus Pasteurella multocida Proteus mirabilis</p>

Table 2 Commonly isolated aerobic bacteria from the vagina of normal bitches and female dogs with vaginitis (Kustritz, 2006a)

6.5 Urinalysis and bacterial culture

Urinary tract infections and vaginitis often occurs at the same time. It is often hard to tell if it was the vaginitis that caused the urinary tract infection or opposite. When we want to diagnose a urinary tract infection the urine is collected directly from the urinary tract, cystocentesis, because the urine would otherwise be contaminated with vaginal contents. Urine analysis and aerobic bacterial culture is recommended to be carried out after sampling. (Kustritz, 2008).

Cystocentesis is either carried out when the animal is standing or laying on its side. In dogs the bladder is harder to palpate in dorsal recumbence. The bladder is located by palpation and fixated with the fingers. The sample is obtained by introducing the needle through the midline of the abdominal wall (Rijnberk & Van Sluijs, 2009). The urine is evaluated by its physical characters, biochemical parameters and on what microscopic sediments you could detect. Physical characteristic of the urine includes colour, clarity and volume. Biochemical parameters in the urine are pH of the urine, presence of blood, glucose, ketones, bilirubin, urobilinogen and protein. Sediments from the urine evaluated in the microscope can be RBC, WBC, organisms, epithelial cells, crystals and casts (Reine &Langston, 2005).

6.6 Urinary incontinence

It is often challenging to diagnose urinary incontinence due to its complex nature. When making a diagnosis it is important to differentiate between urinary incontinence associated with neurological signs and non-neurogenic UI. A detailed neurological examination of the dog may be helpful to determine which of these groups of incontinence the dog belong to. To further distinguish the "involuntary" loss of urine from possible behaviour problems the owner must be questioned about the place and position of the dog during episode of UI. In case of urinary leakage, the dogs usually do not try to reach to a certain place or make the normal position for micturition. When making a diagnosis gender, age, breed and reproductive status has to be taken into consideration. Urinary incontinence that have occurred after neutering of the bitch is most likely urinary sphincter mechanism incompetence (USMI). In puppies UI is thought to be due to congenital malformations such as ectopic ureters, congenital USMI, persistent urachus bladder diverticulum, bladder or urethral hypoplasia (Reichler & Hubler, 2015).

Urinary incontinence also has to be distinguished from dysuria and polyuria. Painful micturition, dysuria, can be due to a urinary tract infection or other conditions of the urinary tract. Excessive urination, polyuria, has to be differentiated from other disorders resulting in polydipsia, like Diabetes or Cushing disease. Polydipsia can be diagnosed by measuring the water intake of the dog. A healthy dog normally consume around 50-60ml/kg/day (Schoeman, 2008).

Methods that aid in diagnosing urinary incontinence often include urine analysis, urine culture, x-rays and ultrasound of the abdomen. Cystoscopy can be used for a direct inspection of the urethra and bladder. Contrast study is carried out if ectopic ureter or other anatomical abnormalities are suspected. First a dye is injected either to a vein or the bladder which then is followed by a series of x-ray (Langston, 2011).

6.7 Brucella canis

Vaginitis caused by *Brucella canis* is diagnosed based on patient history, clinical signs and serological screening with bacterial isolation from either blood or contaminated tissue (Sant'Anna et al, 2012). Since it often is difficult to diagnose, several techniques may be used in combination, like culture, PCR and serology. For the detection of antibodies of *B.canis* rapid slide agglutination test(RSAT) and the tube agglutination test(TAT) is often used. Others serological methods that have been used are agar gel immunodiffusion (AGID), enzyme-linked immunosorbent assay (ELISA), indirect fluorescent antibody (IFA) test , complement fixation, a lateral flow-immune-chromotographic assay (LFIA) and counter-immunoelectrophoresis. When making a diagnosis of *Brucella canis* based on serology several factors have to be taken into consideration. The possibilities of false positive reactions and cross reactions are important to keep in mind. In young animals during an early stage of infection and in chronically infected animals antibodies may be absent resulting in a false negative (CFSPH, 2012).

Rapid slide agglutination is used as a screening test for *Brucella canis*. A test kit containing 2-mercaptoethanol(2-ME) is available (Quinn et al, 2016). The 2-ME will eliminate nonspecific IgM reactions and is important in preventing false positive results. This method detects serum antibodies to surface antigens of the bacteria. When using this method a positive result has to be confirmed by other methods such as PCR or blood culture (Kahn, 2010).

Polymerase Chain Reaction(PCR) is a technique used in labs to make millions or even billions of copies of a specific DNA region that is wanted. It can be carried out by using a DNA source from a variety of tissues and organisms, such as skin, hair, peripheral blood, saliva and microbes. It is considered a sensitive method as only small amount of DNA has to be present to generate enough copies to be analysed. For carrying out PCR the presence of template DNA, primers, nucleotides and DNA polymerase is required. The key enzyme is DNA polymerase, which will link the nucleotides together to form the PCR product. The components are mixed in a test tube and placed into a machine where repeated cycles of DNA amplification will occur in three basic steps. The first step is denaturation. Here the temperature is heated to above melting point of the two complementary DNA strands of the target DNA which allows the strands to separate. Second step is annealing. Here the temperature is lowered so that the specific primers can bind to the target DNA segments. Annealing will only take place between primers and target DNA if they are complementary in sequence. In the third step the temperature is raised again allowing the DNA polymerase to extend the primers by adding nucleotides to the developing DNA strand. Analysis of the PCR product is done after the amplification process. There are different methods for visualising the PCR products. It can be done by staining the DNA product with a chemical dye or by labelling the PCR primers or nucleotides with a dye before making copies of the DNA. Agarose gel electrophoresis is the most commonly used method for analysing the PCR result. Here the DNA products will get separated based on size and charge (Garibyan & Avashia, 2015). *B.canis* can be detected in samples such as vaginal and uterine swabs, semen and urine by the use of real time polymerase chain reaction, which is a quantitative PCR method (CFSPH, 2012).

Confirmation of *B.canis* can only be made after a positive blood culture.. *Brucella* spp. can be cultured on both plain or selective media. Culturing of *B.canis* may require some time as the growth of the bacteria is slow. The bacteria colonies appear as rough (CFSPH, 2012).

6.8 Canine herpesvirus

Canine herpes virus in adult dogs are often present without the animal showing obvious clinical signs of the disease. However, in the acute phase of the initial infection lymphoid nodules, submucosal haemorrhage and hyperaemia may be present at the site of mucosal virus inoculation. In both males and females vesicular lesions can be observed in the area of the genitalia. From these symptoms a virus infection can be suspected and further diagnostic tests

are carried out. The most common method for detection of CHV-I is serological testing. Due to the fact the virus is poorly immunogenic serological testing can be confusing. When making a proper diagnosis paired sera samples has to be taken 10 to 14 days apart. If there is a fourfold rise in antibody titers it is considered as presence of an active infection (Morresey, 2004).

Characteristic lesions seen during necropsy of dogs infected with canine herpes virus are multifocal haemorrhages in the liver, kidney and lungs. When making a cut surface in the affected kidney of a new-born, haemorrhages radiating from the renal pelvis may be observed. The serosa of the intestines are also affected in some cases. Together with splenomegaly and lymphadenomegaly, necrosis and haemorrhages of lymph nodes, spleen and adrenal gland are often present. The lungs are oedematous and the larger airways of the neonates are filled with frothy fluid. Whole virus or viral antigen is recoverable from vascular endothelium, liver, adrenal glands, lungs, spleen, kidneys and lymph nodes from aborted foetus and neonates. From these tissues fresh-chilled samples should be collected (Morresey, 2004).



Figure 5 Renal haemorrhages in kidney (Morresey, 2004)

During histopathology, microscopic examination of biological tissue, multifocal necrosis and intranuclear inclusion bodies are common findings. Tissue samples are taken from liver, spleen, lungs, kidneys, pancreas, heart, intestine and adrenal glands. The intranuclear inclusion bodies found are basophilic to weakly acidophilic. This depends on the phase of infection and staining method. In addition to the lesions in the organs, lesion in the central nervous system can be present. The lesions include nonsuppurative meningoencephalomyelitis, ganglioneuritis and retinal dysplasia. By immunohistochemistry, a process in where antibodies are used to detect antigens, viral antigens can be detected in the tissues (Morresey, 2004).

7. Treatment

Treatment of vaginitis depends on the age of the bitch and the causative agent. It can vary between local cleaning and disinfection of the vagina and surrounding area, surgery to correct anatomical abnormalities, treatment of underlying systemic diseases and use of antibiotics after culturing and sensitivity tests (Kustritz, 2008).

7.1 Juvenile vaginitis

In puppies with mild clinical signs treatment is normally not required. In some puppies it may be beneficial to let the dog go through on heat cycle. This can hasten the resolution of the vaginitis. If this is due to the fact that an older dog will have a better immunity or if it is because of the hormonal increase and the subsequent changes that occur in the vagina is not known (Kustritz, 2006b). As a consequence of excessive licking and self-trauma to the vagina it still might be beneficial to clean the perivulvar area with either baby wipes or nonalcohol-based otic cleanser. Otic cleanser is used as it is mild and non-irritating. In puppies presenting clinical signs of atopy like pruritus, alopecia, licking of the paws and recurrent otitis, therapy for atopy may in some cases be beneficial (Kustritz, 2010).

Puppies with severe clinical signs require treatment. Antibiotics are selected based on results from bacterial culture and sensitivity testing collected from vaginal sampling. Based on experience amoxicillin-clavulanate has showed to be effective against 91 to 100 % of the bacteria that commonly causes vaginitis in dogs (Kustritz, 2010). Norocalv vet ® contains amoxicillin-clavulanate. It is a broad spectrum penicillin with a quick onset of bactericidal effect against Gram positive and Gram negative bacteria. The use of Norocalv vet ® is contraindicated in dogs with known hypersensitivity to penicillin or other beta-lactam antibiotics. In dogs with known liver and kidney problems the dosage given has to be carefully evaluated (Felleskatalogen, 2010). In addition to treatment with antibiotics, it is important to identify the underlying cause of inflammation and correct it. Underlying causes of juvenile vaginitis could be urinary tract infections and vaginal abnormalities. Recurrent urinary tract infections can be investigated by cystocentesis or radiography to detect uroliths. Anatomical anomalies found during vaginoscopy may be repaired by surgery. This is rarely carried out in dogs before they have reached maturity (Kustritz, 2010). It is not known if a puppy presenting vaginitis in young age is more prone to get adult-onset vaginitis or if spaying dogs with puppy vaginitis will prevent the resolution of the vaginal inflammation (Kustritz, 2006b).

7.2. Adult-onset vaginitis

The main key in treatment of adult-onset vaginitis is to find and correct the anatomical abnormalities and predisposing factors. If this is not done, there will be recurrence of the inflammation after treatment (Sant Anna et al, 2012). The most common primary problems in dog presenting vaginitis is urinary tract infections which is reported in 26% to 60% of cases, vaginal anomalies which is reported in 20% to 35% of cases and systemic disease which is reported in 15% of cases (Kustritz, 2008).

Based on culture and sensitivity tests from vaginal sampling, appropriate antibiotic therapy is started. As for the puppy vaginitis, orally administrated amoxicillin-clavulanate has shown to be effective in 91% to 100% of bacteria commonly seen in vaginitis (Kustritz, 2008). In adult onset vaginitis it is recommended to use antibiotics for one month. In addition to amoxicillin-clavulanate drugs like ampicillin, trimethoprim-sulphonamide, enrofloxacin and cephalosporin are often used as these drugs are generally effective against Gram-positive and Gram negative bacteria in the genitourinary tract. Tetracycline and chloramphenicol are mostly indicated for treatment of Gram negative bacteria. If the dog seems to have discomfort and frequently is licking in there area or if of there is presence of purulent discharge, it is advised to clean the perivulvar area to prevent spreading of the infection to other areas nearby (Sant Anna et al, 2012).

If the vaginal discharge has accumulated, cleaning can be beneficial. 0,05% chlorhexidine, 0,5% povidone-iodine or 0,2% nitrofurazone can be used for cleaning. This is done twice a day until the secretion is reduced. In addition to this, cleaning with saline solution several times a day may be helpful together with administration of vitamin C. Vitamin C acidifies the local secretions and thereby helps to control the infections (Sant Anna et al, 2012). Treatment of a possible urinary incontinence can also help to resolve the vaginitis as this can be an underlying cause. Accumulation of the urine will result in irritation of he vaginal mucosa. Diethylstilbestrol is one of the drugs that can be used for treatment of urinary incontinence. In case of vaginitis associated with recessed vulva or vestibulovaginal stenosis surgical interventions has to be taken into consideration (Greene, 2011).

7.3. Vulvoplasty

A very common underlying cause of vaginitis are vaginal abnormalities. These abnormalities can cause accumulation of urine and result in irritation of the vaginal mucosa. Vulvoplasty, also called episioplasty, is the resection of perivulvar folds. It may decrease the incidence of chronic or recurrent urinary tract infections and urinary incontinence in recessed vulva (Kustritz, 2006b). The excessive skin folds form a "cap" around the vulva and this will result in failure of the cleaning and topical medication of the area. Vulvoplasty will lead to a permanent end of the problem. Before the surgery, physical examination of the area and vaginoscopy is carried out. For the surgery the animal is placed in a sternal recumbence with the hind legs placed to the side and the tail tied forward to get a good overview and to prevent contamination of the surgical site. After fur removal, cleaning and disinfection of the area, the surgery can start. A horseshoe shaped incision is made from 8 o'clock to 4 o'clock position around the vulva. Then a subcutaneous closure is made followed by skin closure. This is not considered as a major surgery. After the surgery post-operative antibiotics and pain relief is given since pain, inflammation and infection possibly can occur after the operation. The dog is often irritated by the surgical wound and because of this the dog has to wear an Elizabethan collar until the sutures are removed. The removal of suture will be around 10-14 days post-operative (Anderson et al, 2003).

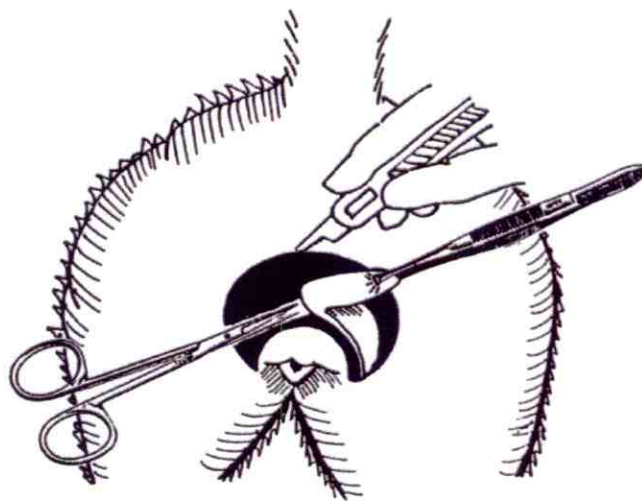


Figure 6 Vulvoplasty (Anderson et al, 2003)

7.4 Bacterial infections

The main problem with vaginitis associated with bacterial infections is to determine if it was urinary tract infection that caused vaginitis or if vaginitis that caused the urinary tract infection. Vaginal culturing and urine sample taken by cystocentesis is carried out to get sample for bacterial culturing and bacteria sensitivity testing. Bacterial culturing is done to identify the causative agent and the dominant microorganisms resulting in the infection. It is important to find out bacteria and carry out sensitivity testing to ensure correct and effective treatment (Kustritz, 2008).

Culturing of sample can be done in Petri dishes containing a growth medium enhancing bacterial growth. Medium commonly used are nutrient agar, blood agar, MacConkey agar, Edwards medium, chocolate agar and brilliant green agar depending on what bacteria that is suspected. Inoculation of bacteria is done by striking of the sample swab on the plates. A special technique is used when inoculating the bacteria to facilitate growth. After incubation the bacteria is identified by its morphological characteristics and based on biochemical tests. When choosing the most effective antibiotics for treatment, antimicrobial susceptibility testing is done. Several methods for sensitivity testing are known, these include broth dilution, disc diffusion, agar gradient and some automatic methods (Quinn et al, 2016).

I will take a closer look on the antimicrobial susceptibility testing by disc diffusion. First the sample is evenly smeared out on the surface of the Petri dish. Afterwards the antimicrobial discs are added. Then the sample has to be incubated for a certain time and at a given temperature. The result is based on the zones of inhibition observed after the incubation period. Where you can see growth of bacteria around the impregnated disc the bacteria is resistant against the antibiotic. If there is no bacterial growth you can conclude that the organism is sensitive to the bacteria (Quinn et al, 2016).

7.4.1 Brucella canis

Brucella canis has a zoonotic potential. The bacteria can be persistent in lymph nodes, spleen, uterus and prostate, even after treatment. An outbreak is possible when an animal is stressed. Because of this treatment is not encouraged, it is only tried in animals with high emotional value. Treatment is done by castration/neutering of intact animals, prolonged antibiotic therapy and strict serological monitoring. In kennels euthanasia normally is recommended. As there is no treatment nor a vaccine, prevention of infection is important. In kennels the canine

brucellosis is normally introduced by an infected dog or semen. All dogs should therefore be isolated and tested before entering a kennel. The serological test has to be repeated before release from quarantine as an early test may be false negative. Some also recommend testing before breeding. Good hygienic routines can control the disease due to the fact that *B.canis* is sensitive to various disinfectants. Some kennels have managed to eradicate canine brucellosis with proper sanitation, repeated testing and removal of infected dogs and quarantine with repeated testing of the dogs before entering the kennel (CFSPH, 2012).

7.5.Urinary incontinence

Medicated treatment against urinary incontinence(UI) is in most cases successful independently of the age at spaying and degree of incontinence. Before treatment it is important to identify and treat underlying problems causing polyuria and/or coexistent cystitis. Alpha-adrenergic agonists are considered as the best treatment of UI. This will result in an increase in the urethral closure pressure because the alpha-adrenergic receptors in the internal urethral sphincter gets stimulated. Phenylpropanolamine and ephedrine are alpha-adrenergic agonist used for treatment. The success rate for phenylpropanolamine varies from 86-97% and 74-93% for ephedrine. A study comparing the effect of phenylpropanolamine and pseudoephedrine has been carried out. The same dose of phenylpropanolamine and pseudoephedrine was given to dogs with with UI. This showed that dogs responded better to phenylpropanolamine and that side effect were less often observed. The possible side effects in the use of alpha-adrenergic agonists are gastrointestinal irritations, anorexia, nervousness, aggressiveness or apathy. In most kidney diseases, heart problems and glaucoma where an increase in the blood pressure should be avoided the use of alpha-adrenergic agonists are contraindicated (Reichler & Hubler, 2014).

In females that don't respond properly to phenylpropanolamine alone, oestrogens can be combined for the treatment due to the fact that oestrogens sensitize the alpha-receptors and will potentiate their effects. Short acting estrogens are used. This is to avoid complications that can occur in some rare cases with the usage of long-acting synthetic estrogens. In intact bitches the use of estrogens should be carefully considered, as it may result in bloody vaginal discharge and uterine diseases. Some of the medications used in humans to treat UI can also be applied to dogs, for example duloxetine and imipramine (Reichler & Hubler, 2014).

An other option for treatment is the subcutaneous application of GnRH analogues. For patients showing side effects with the use alpha-adrenergic analogues or in animals where the use of alpha-adrenergic analogues are contraindicated, this is a good choice. This will result in increased bladder compliance and is shown to be effective as a single therapy in 50% of bitches with UI. In patients that don't show any sign of improvement in the use of alpha-adrenergic agonist or GnRH analogues the two medications can be combined to see if this will have a positive effect. If there is a recurrence of the problem after initial treatment diagnostic procedure should be repeated and further treatment discussed. Surgical procedures can be taken into consideration (Reichler & Hubler, 2014).

There are several options for surgical treatment of urinary incontinence. Urethropexy, cystourethropexy, colposuspension, urethral lengthening and artificial sphincters are some of the methods. During colposuspension the bladder neck is relocated into an intra abdominal position. This is thought to help prevent leakage by improving pressure transmission and compression of the bladder. The bitch has to be neutered for this surgery to be carried out. During urethropexy the bladder neck is relocated into a more cranial position by anchoring the urethra to the tendons in front of the pelvic floor. Support is provided to the urethra. There is no treatment that can guarantee 100% success. A detailed examination always has to be carried out to provide the best treatment, which may be both medical and surgical (Pratschke, 2015).

7.6. Idiopathic vaginitis

Many dogs present vaginitis with an unknown source of origin. In this case there is not observed any anatomical abnormalities, foreign bodies, infections or any sign of neoplasia. In ovariectomized bitches, estrogen treatment is often beneficial. Treatment for several weeks are necessary before any improvement may be observed. The oral estrogen treatment is similar to the treatment carried out in dogs with incontinence due to urethral sphincter incompetence (Kustritz, 2008).

8.Summary

Vaginitis in the bitch has to be further studied and understood to aid in identification and treatment of the illness. The pathophysiology is not completely understood. We know many underlying causes of the problem and by reducing these, the incidence may be decreased. No age or breed predisposition has so far been proven. Vaginitis is more commonly seen in spayed bitches than in intact bitches. The relationship between spaying and vaginitis is not completely understood and has to be further elucidated.

As I mentioned earlier, there are two different types of vaginitis depending on age. For the puppy vaginitis the best thing is to wait until the dog comes into estrus for the first time before starting with further treatment. Puppy vaginitis often spontaneously resolve when the puppies enter estrus. If it is due to the fact that the immunity increases with age or if it is caused by the changes in the vagina because of the hormonal increase is not precisely known. For the adult-onset vaginitis the main key is to treat and correct the anatomical abnormalities and predisposing factors to get successful treatment and prevent recurrence of the problem.

When making the diagnosis it is important to remember that several physiological and pathological conditions often have similar clinical signs as dog presenting vaginitis. A detailed examination and elimination of other disease or physiological conditions, should be carried out by the veterinarian when making a conclusion. In case of vaginitis caused by bacteria it may be hard to find the aetiological agent due to the residential microbial growth in the vagina. Therefore, laboratory tests are often not the first choice for diagnostic purposes. A thorough clinical examination, vaginal inspection by vaginoscopy and digital palpation and serological screening are often a good tool for diagnostic purposes. More studies in the area would be helpful for better understanding of the problem.

9. Bibliography

Anderson, S., Gill, P., Lippincott, L., Somerville, M., Shields, S., Balfour, R.J., Wilson, E., (2003), Southern California Veterinary Medical Association's Official Magazine, Episioplasty- vulvar fold resection, 15-18, Available at: <http://www.asecvets.com/pdf/dimsurg/DimSurg0803.pdf>, [Accessed: 18.03.2017]

Baba, E., Hata, H., Fukata, T., Arakawa, A., (1983), Vaginal and Uterine Microflora of Adult Dogs, *Am J Vet Res*, 44(4), 606-609

Center For Security & Public Health (CFSPH,) (2012), Canine Brucellosis: Brucella canis contagious abortion, undulant fever, , Available at: <http://www.cfsph.iastate.edu/>, [Accessed at: 18.02.2017]

Davidson, A.P., (2015), Determining Canine Estrus Stage Cycle via Vaginal Cytology, 19-21, Available at: <http://www.cliniciansbrief.com/sites/default/files/attachments/Determining%20Canine%20Estrus%20Via%20Vaginal%20Cytology.pdf> [Accessed at: 25.02.2017]

Fabbi, M., Manfredi, S., Di Ianni, F., Bresciani, C., Cantoni, A.M., Gnudi, G., Bigliardi, E., (2014), A vaginal fornix foreign body in a bitch: a case report, *Veterinarni Medicina*, 59(9), 457-460

Felleskatalogen(2010), Noroclav Vet – Antibiotikum, Available at: <http://www.felleskatalogen.no/medisin-vet/noroclav-vet-norbrook-562096> [Accessed: 13 March 2017]

Gariyban, L., Avashia, N., (2015), Polymerase Chain Reaction, *Journal of Investigative Dermatology*, 133(3), 1-4

Greene, C.E, (2012), Infectious diseases of the dog and cat, Missouri, USA, Elsevier Inc., 1038

Hill, P., Warman, S., Shawcross, G., (2011), 100 Top Consultations in Small Animal General Practice, UK, John Wiley & Sons Ltd., 250

Kahn, C.M.(BA, MA), (2010), The Merck Veterinary Manual, USA, Merck & Co., Inc., 706-707,1286, 1485, 1499

König, H.E., Liebich, H.G., (2009), Veterinary Anatomy of Domestic Mammals, Stuttgart, Germany, Schattauer GmbH, 423, 433-435

Kustritz, M.V.R., (2010), Clinical Canine and Feline Reproduction : Evidence-Based Answers, Iowa, USA John Wiley & Sons, Inc., 133-137

Kustritz, M.V.R., (2008), Vaginitis in dogs: A simple approach to a complex condition, Veterinary Medicine, Available at: <http://veterinarymedicine.dvm360.com/vaginitis-dogs-simple-approach-complex-condition> [Accessed: 11.02.2017]

Kustritz, M.V.R, (2006a), Collection of tissue and culture samples from the canine reproductive tract, *Theriogenology*, 66(3), 567-574

Kustritz, M.V.R., (2006b), The Dog Breeder`s Guide to Successful Breeding and Health Management, Missouri, USA, Elsevier Inc., 263-265

Langston, E., (2011), Urinary Incontience in Dogs, <http://www.kachinaanimalhospital.com/assets/urinary-incontinence-in-dogs.pdf>

Lluch, S.C., Mas, T.R., (2014), Vaginitis study in female dog: a simple attempt to explain a complicated condition, Available at: https://ddd.uab.cat/pub/tfg/2014/141512/TFG_scaballerialluch_poster.pdf [Accessed at: 18.02.2017]

Lulich, J.P., (2006), Endoscopic vaginoscopy in dogs, *Theriogenology: An international journal of animal reproduction*, 66(3), 588-591

Morresey, P.R., (2004), Reproductive Effects of Canine Herpesvirus, *Compendium on Continuing Education for the Practising Veterinarian-North-America Edition*, 26(10), 804-810

Nelson, W.R., Couto C.G., (2009), *Small Animal Internal Medicine*, Philadelphia ,USA Elsevier Inc., 892-894

Pratschke, K.M., (2015), Urinary incontinence in veterinary patients: not just a medical problem, *Veterinary Ireland Journal* ,5,(6), 285-290

Quinn, P.J., Markey, B.K., Leonard, F.C, Fitzpatrick, E.S., Fanning, S., (2016), *Concise Review of Veterinary Microbiology*, UK, John Wiley & Sons Ltd ,76,79

Reece, O.W., (2009), *Functional Anatomy and Physiology of Domestic Animals*, Iowa, USA, John Wiley & Sons, Inc, 458-459

Reichler, I. & Hubler, M. (2014). Urinary Incontinence in the Bitch: An Update. *Reproduction In Domestic Animals Reprod Dom Anim*, 49, 75–80.

Reine, N.J, Langston, C.E., (2005), Urinalysis interpretation : How to squeeze out the maximum information from a small sample, *Clinical Techniques in Small Animal Practice*, 20(1), 2-10

Rijnberk, A., Van Sluijs F.J.,(2009), *Medical History and Physical Examination in Companion Animals*, Houten, Netherlands, Elsevier Limited, 113-114

Sant' Anna, M.C., Fabretti, A.K., Mello Martins, M.I., (2012), Clinical approach to canine vaginitis, *Semina: Ciências Agrárias*, 33(4), 1543- 1553

Schoeman, J. P. (2008). Approach to polyuria and polydipsia in the dog. *Proceedings of the 33rd World Small Animal Veterinary Congress 2008 - Dublin, Ireland*, 421-423.

Shiju, S.M., Justin, W.B., Kannan, T.A., (2012), "Innie" Vulva and associated Puppy Vaginitis – A Report of Five cases , *Intas Polivet*, 13(1), 132-133

Silverman, S., Long, C.D., (2000), The Diagnosis of Urinary Incontinence and Abnormal Urination in Dogs and Cats, *The Veterinary Clinics of North America: Small animal practice*, 30,2, 427-448

Sjaastad Ø.V., Sand, O., Hove, K., (2010), Physiology of Domestic Animals, Oslo, Scandinavian Veterinary Press, 701,704

Ucar, M., Cingi , C.C., Civelek, T., (2011), A New Curative Approach to Puppy Vaginitis, *YYU Veteriner Fakultesi Dergisi*, 22(1), 65

Watts, J.R., Wright, P.J., Whithear, K.C., (1996), Uterine, cervical and vaginal microflora of the normal bitch throughout the reproductive cycle, *J. Small Animal Pract.*, 37(2), 54-60

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