Review Paper

Normal and pathological vaginal microflora in the bitch-a review

ABSTRACT

The vagina is not only a place for the development of various microorganisms, but also serves as a border before reaching the uterus of all mammals. Determining the qualitative and quantitative specifics of vaginal bacterial flora is of great importance for a better understanding of genital pathology mechanism, clinical diagnosis, management and antibiotic treatment of reproductive diseases in the bitch.

Keywords: vagina, bitch, bacterial flora

Introduction

A comparatively limited analysis of the vaginal microflora in the bitch has been performed in the literature. The type of isolated microorganisms from healthy or bitches with reproductive diseases is important because in the presence of some predisposing factors, the development of opportunistic bacteria may escalate and cause different pathological processes in the reproductive system and the whole organism [1].

Materials and methods

Various types of microorganisms are isolated from the vagina of bitches [2-9]. Age specificity has been determined [10]. In a large percentage of non-sexually mature female dogs more coagulase-positive staphylococci have been found compared to those who have reached puberty [11]. In one study, bacteria were found in 86% of the animals before the first estrus occurrence and in 84% after the onset of puberty [12]. No differences were found between the microorganisms isolated from animals prior to the onset of puberty, spayed or intact females and those living in the cranial or caudal part of the vagina [10,13]. Other authors detected microorganisms between 89.7% [14] and 96% [3] of the vaginal samples tested. Some found the existence of monocultures [6,15,16] and others mixed isolates [12,17], both from aerobes and anaerobes [2,3,18].

Results and discussion

The most frequently isolated bacteria from the vagina of bitches are *E. coli, Staphylococcus spp., Streptococcus spp., Pasteurella spp., Proteus spp., Bacillus spp., Corynebacterium spp., Pseudomonas spp. and Micrococcus spp.* Less common isolated are *Neisseria spp., Klebsiella spp.* and *Moraxella spp.* [8-10,14,15,17-26]. Some of these bacteria are isolated from both fertile and infertile dogs [2] with similar types of aerobes as part of the vaginal microflora of both groups of animals [11].

Isolation of *Mycoplasma spp.* [3,20,27,28] and *Ureaplasma spp.* [27,29,30] has been reported in 30 to 88% of the samples of bitches without reproductive problems. *Mycoplasma* isolates from the vaginas of healthy bitches did not vary during the various stages of the estrous cycle [31]. Rarely anaerobic bacteria were found in healthy bitches, such as *Bacteroides spp.* and *Peptostreptococcus spp*. [3,23].

The presence of lactic acid bacteria *(Lactobacillus* and *Enterococcus*) in the vagina of the bitch has been reported. Their importance is expressed in suppressing the development of pathogenic microorganisms in the urinary and reproductive systems by synthesizing bacteriocins and hydrogen peroxide and disrupting their adhesion to epithelial cells [32,33].

In the bitch, the presence of fungus is rarely found [2,12,30]. In a mycological study before and during the first estrus, a presence of *Malassezia spp.* [34] and *Candida spp*. [35,36] was recorded as a very rare finding. There are also reports for isolation of *Penicillium spp.* and *Malassezia pachydermatis* [37]. Other authors found that *Malassezia pachydermatis* is the most commonly isolated yeast as a part of the normal canine surface microbiota, followed by *Candida parapsilosis*, *Candida tropicalis*, *Candida albicans, Saccharomyces cerevisiae* and *Rhodotorula spp*. [38].

In some studies the authors argue that there may be a difference in vaginal microorganisms during the different stages of the estrous cycle in bitches [10,15,39]. According to some authors there is no such a difference [13,35,40]. Pure bacterial cultures can be isolated from the vagina of healthy bitches during proestrus and anestrus, while mixed bacterial cultures are found during estrus and diestrus [39]. *E. coli* and *Streptococcus spp.* are isolated during all the stages of the estrous cycle in the bitch, but not during pregnancy [41]. According to the same authors, β-hemolytic streptococci are often found in estrus and early diestrus, and α-haemolytic streptococci in the other stages of the cycle.

Other authors reported only an increase in the number of isolates during proestrus and estrus [1,3,14,22,42,43]. There are reports that the smallest number of bacterial isolates were found through proestrus [44,45]. According to them the reason for this is the continuous passing through the vagina of fluid from the uterus. The highest number of isolates they found during diestrus and pregnancy, which according to them is due to the high progesterone concentrations. These levels of progesterone and the pH values typical for these periods provide favorable conditions for the development of microorganisms in the sexual system [46]. It is also suggested that immunosuppression occurs during the luteal phase, which further promotes the proliferation of microorganisms [45].

It is impossible to find an etiological connection between the isolation of a particular microorganism and the occurrence of a specific genital disease in the bitch [18] and is very difficult to associate a disease with a specific bacterial isolate due to the wide variety of microorganisms into the vagina of bitches with or without reproductive diseases [10]. Only *Brucella canis* is mentioned as a specific microorganism and etiological agent of a disease [23].

Different investigations have shown that microorganisms into the vagina of clinically healthy bitches are isolated also from patients with genital system inflammation [13,17]. The most common are *E. coli, Staphylococcus spp., Streptococcus spp.* [17,25,47,48] and *Pasteurella spp.* [6,17]. Less common isolated are *Pseudomonas spp.* [6,22], *Proteus spp., Citrobacter spp.* and *Enterobacter spp.* [6,13]. There is a higher percentage of *Staphylococcus spp.* in bitches with vaginitis compared to healthy ones [6]. They are also predominant isolates in young compared to adult animals [18]. Limited information is available regarding the vaginal microbiota of normal spayed dogs and spayed dogs with recurrent urinary tract inflamations

(UTI), but the results showed that vaginal microbiota of spayed female dogs with recurrent UTI was similar to the control population of normal, spayed female dogs [49]. The microbiome of the endometrium is distinctly different from that of the vagina [50].

In a study of bitches with chronic vaginitis were isolated *Streptococcus spp., Staphylococcus spp., Proteus spp.* and *Bacillus spp.* and in healthy animals during estrus-*Klebsiella spp., Staphylococcus spp., Corynebacterium spp.* and *Proteus spp*. [13,51,52]. Some authors reported that the isolated microorganism during a disease of the reproductive system should not necessarily be considered as a cause of the disease [18].

Because most of the bacterial species in the caudal part of the genital tract in the bitch are opportunistic microorganisms, the interpretation of the results without additional information from the anamnesis and the clinical finding is generally not possible. An exception in this aspect is *Brucella canis* [53].

High bacterial growth, especially monocultures, may serve as a pathological finding associated with the presence of vaginal discharge (most commonly purulent) and finding leukocytes in exfoliative vaginal cytology, with the exception during the early diestrus [1].

CONCLUSION

The importance of infections in the pathogenesis of infertility and reproductive disorders in the bitch may be exaggerated. It is possible some microorganisms to penetrate through a transcervical migration from the vagina into the uterine cavity leading to abortion and development of various pathologies and infertility, but it should not be an argument bitches to be treated prophylactically with antibiotics before insemination.

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