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Original Scientific Paper

FREQUENCY OF REPRODUCTIVE DISORDERS IN DOGS

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Summary
Diseases and reproductive tract disorders are common in clinical veterinary practice, and the possibility of applying therapy plays a key role for future offspring. The awareness of pet owners about the health status of their animals has changed significantly in recent years. On the other hand, due to the changed way of keeping dogs, they are more prone to various health disorders, including reproductive health disorders. When examining the reproductive status of dogs, it is always necessary to take a detailed history of reproductive health. In this retrospective study, data taken from 95 dogs with reproductive tract pathology were analyzed. In addition to the most common reproductive disorders, some rare congenital pathological conditions were also detected in these dogs. The highest frequency of reproductive pathology was recorded in females (73%), followed by males (22%), while neonatal patients were least affected by this type of pathology (5%). Surgical intervention was performed in 71% of cases, while pharmacotherapy was used in 24% of patients. In cases of neonatal disorders, only the death of the puppy was noted (5% of cases). The reproductive history of the bitch, the male and the litter can provide excellent guidelines for the existence of a genetic predisposition to the development of sterility. Therefore, this retrospective study was conducted with the aim of presenting different reproductive disorders, possible therapies for different disorders, but also the incidence of their occurrence in relation to gender and age. Overall, the problems that most often occur in veterinary practice, and relate to the pathology of canine reproduction, remain similar for a long period of time. A positive effect in such disorders can be found in quick and easy diagnosis, but also in increasingly modern methods for their correction.

Keywords: sterility, pharmacotherapy, surgery, dogs.

INTRODUCTION

Due to the great need of people to have pets, the dog population in major cities is increasing year by year. Obtaining an increasing number of healthy and viable dog

offspring also leads to an increase in reproductive problems of adult dogs used in reproduction. This is the reason why today's veterinary practice requires the use of modern methods for diagnosing and resolving pathological processes of the reproductive tract of dogs. Many of these pathological conditions can occur at any time during the reproductive life of dogs. In order to avoid incorrect therapy or unnecessary delays, it is important for the clinician to quickly recognize and understand the pathology of the most common reproductive disorders (Ortega-Pacheco et al., 2012). Gynecological or andrological examination of dogs in order to determine the cause of infertility should be performed according to an established scheme, which includes anamnesis, clinical examination, as well as laboratory analyses (Holumbiovska and Stefanyk, 2018). Infertility is a temporary, prolonged or permanent loss of reproductive ability (Pavlović, 2018). Reproductive function disorders are caused by various etiological factors: inadequate fertilization, stress, disease of individual reproductive organs, infectious disease and idiopathic infertility (Holumbiovska and Stefanyk, 2018).

Reproductive disorders in dogs can be congenital and acquired. Acquired reproductive disorders, in today's veterinary practice (with modern diagnostic procedures), can be much easier to remove, that is, they can be much easier to manage. Congenital disorders, or congenital sterility, can be repaired in a certain number of cases during surgery, but this often ends the reproductive activity of the individual. Infertility of female dogs occurs more often than in males, but pathological conditions that occur in males should also treat with serious observation and analysis (Stančić and Galić, 2021). The increase in infertility may be a consequence of the domestication and use of dogs in different human activities, and for this reason, great attention is given to the reproduction of pets (Stančić, 2012; Galić et al., 2022). The impact of domestication itself is indicated by the fact that dogs are considered descendants of wolves, but unlike dogs, the female wolf has only one estrous period per year (Nagashima and Songsasen, 2021), and that is the period when the wolf produces sperm. On the other hand, domestication has led to the fact that female dogs most often have two/three estrus periods per year, while male dogs produce fertile sperm throughout the year (Ortega-Pacheco et al., 2006; Stančić, 2012).

During pregnancy and intrauterine development, a large number of disorders are very difficult to detect, and even when diagnosed, they remain without possible surgical intervention or pharmacotherapy (Münnich and Küchenmeister, 2014; Pereira et al., 2022). Congenital sterility can be divided into formative and functional. For these forms of sterility, from the point of view of veterinary practice, therapy practically does not exist. Formative disorders represent gross anatomical abnormalities, in which the function of the reproductive organs does not exist. In this sense, formative disorders can be divided into a type when the reproductive organs are completely missing and a type when certain parts of the genital tract are rudimentary (Pavlović, 2018).

The main procedures for determining the cause of infertility are: vaginal secretions, vaginoscopy, vaginal cytology, microbiological studies, radiography, hysteroscopy,

hysterography, ultrasound examination, determination of sex hormone concentrations in the blood, as well as the quality and assessment of ejaculate (Holumbiovska and Stefanyk, 2018; Stančić and Galić, 2021).

Pathological conditions of the reproductive tract are common findings in veterinary practice of pets. Some of these changes, such as pyometra, can seriously affect the reproductive health of pets, which, if not recognized and treated in time, can lead to the death of the animal. Clinicians must be aware of the diversity of reproductive pathology and be prepared to recognize those that require urgent treatment (Ortega-Pacheco et al., 2012). For all of the above reasons, the aim of this retrospective study was to analyze data obtained from 95 dogs with reproductive tract pathology.

MATERIALS AND METHODS

The medical documentation of the Veterinary Clinic (Department of Veterinary Medicine, Faculty of Agriculture, University of Novi Sad) was reviewed to collect information on dogs (males, females and neonatal patients, n=95): different breeds, different ages, for the period from January 2021 to January 2023, with different reproductive problems. All cases of reproductive tract pathology were included, and those that were successfully treated (therapy/surgery), as well as disorders that were detected during surgery (cesarean section/ovariohysterectomy). For each patient separately, and based on the results of a general clinical examination, exploratory surgery, pathohistological findings, ultrasound and X-ray diagnostics, hormonal status, microbiological and cytological smears, a diagnosis for a specific reproductive disorder was made. As soon as a specific reproductive problem was detected, either surgery or medication was suggested. For the surgical procedure, all animals underwent a specialist examination, blood analysis (complete blood count and biochemistry), radiographic and ultrasound examination, and, if necessary, pathohistological analysis of previously sampled biopsies was performed. Surgical procedures were performed under general anesthesia. Anesthesia protocols (premedication, induction and maintenance of general anesthesia) were used based on the biological and health characteristics of each individual. In accordance with the above, different anesthesia protocols were formed in which the following agents were used: sedatives (midazolam, diazepam, xylazine), general injectable anesthetics (propofol, ketamine) and inhalation anesthetics for maintenance of anesthesia (sevoflurane, isoflurane).

Microsoft Office Excel (v2019) was used for the purposes of database creation, analysis of results, and statistical data processing.

RESULTS

Ninety-five dogs (females, males, and neonatal patients) over a two-year period showed reproductive abnormalities.

Patient characteristics are shown in Table 1.

Table 1 Patient characteristics

Parameter	Subgroup	Incidence
Patient	A female individual	73%
	A male individual	22%
	Neonatal patient	5%
	Age from 5 to 10 years	38%
	Age < 5 years	31%
	Age > 10 years	28%
Reproductive disorders of male individuals	Cryptorchidism	14%
	Diseases of the prostate	4%
	Testicular tumors	2%
	Penile prolapse	1%
	Hypospadias	1%
Reproductive disorders of female individuals	Tumors of the mammary gland	26%
	Pseudopregnancy	13%
	Pyometra	10%
	Vaginal prolapse	5%
	Mastitis	5%
	Vulvovaginitis	3%
	Ovarian cysts (discovered during castration)	2%
	Hematometra	2%
	Hermaphroditism	1%
	Maceration	1%
	Rectovaginal fistula	1%
	Injuries of the vulva	1%
	Residual ovary syndrome	1%
	Transmissible veneral tumor (TVT)	1%
	Ovarian tumors	1%
Disorders of neonatal patients detected after caesarean sectin/delivery	Abnormal conditions	2%
	Anasarca	2%
	Gastroschisis	1%
Measures taken	Surgical treatment	71%
	Pharmacotherapy	24%
	Confirmed death	5%
Sterility	Acquired	83%
	Congenital	17%

The highest incidence of reproductive problems was recorded in females (73%), followed by males (22%), and the lowest in neonatal patients (5%). Patients were divided into three groups by age. The first group consisted of patients over ten years of age (28%), the second group consisted of patients between five and ten years of age

(38%), and the last group consisted of patients under five years of age (31%). The following reproductive problems were recorded: mammary gland tumors, prostate diseases (cystic changes and benign hyperplasia) (Figure 1), cryptorchidism, hermaphroditism (Figure 2), ovarian cysts (Figure 3), testicular tumors (Figure 4), pyometra, hematometra, maceration, congenital conditions, anasarca, gastroschisis (Figure 5), vulvovaginitis (Figure 6), pseudogravidity, rectovaginal fistula, vulva injuries, ovarian residual syndrome, vaginal prolapse, mastitis, penile prolapse, hypospadias, transmissible venereal tumor, ovarian tumors.

Figure 1 Ultrasound diagnosis of cystic changes in the dog's prostate

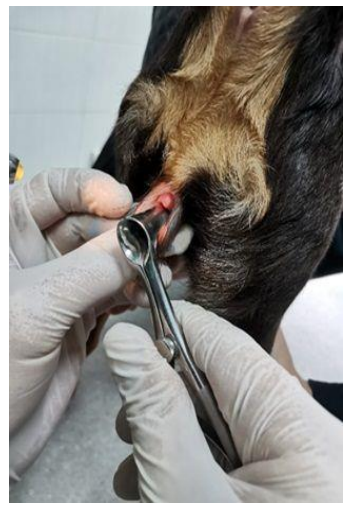

Figure 2 Vaginal examination of a dog and diagnosis of clitoromegaly in hermaphroditism

Figure 3 Incidental finding of a solitary ovarian cyst in an elderly bitch during ovariohysterectomy

Figure 4 Testicular tumor (right-sided changed testicle)

Figure 5 Gastroschisis in a neonatal patient, immediately after cesarean section

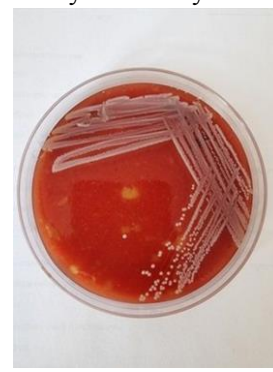

Figure 6 Isolation and identification of the causative agent of vulvovaginitis on blood agar in the microbiology laboratory

Photos: Ivan Galić

In females, the most common reproductive disorders were mammary gland tumors (26%), pseudogravidity (13%) and pyometra (10%).
In males, the most common disorder was cryptorchidism (13%).
Reproductive anomalies in neonatal patients were recorded in a total of 5% of cases, namely, congenital malformation (2%), anasarca (2%) and gastroschisis (1%).
Surgical intervention was performed in 71% of cases, while pharmacotherapy protocols were used in 24% of patients. In cases of neonatal disorders, only the death of the puppy was noted, which was recorded in 5% of cases.
Acquired sterility occurred in 83% of cases, with the highest proportion in older animals (group of individuals aged 5 to 10 years, as well as the group > 10 years), while congenital sterility (17%) was detected in the majority of cases in patients under five years of age (hypospadias, hermaphroditism, rectovaginal fistula, gastroschisis).

DISCUSSION

Retrospective studies, similar to our study, reveal the frequency of various reproductive disorders in the dog population, which is useful for creating prophylactic and clinical strategies, but also for advising pet owners on breeding and reproduction problems in dogs (Hadiya et al., 2021). In our study, mammary gland tumors (24), ovarian tumor (1), transmissible venereal tumor (1) and two testicular tumors in dogs were recorded. Adult animals older than 5 years are most affected, but most reproductive tract tumors do not represent a breed predisposition (Veiga et al., 2009). The results of the study Veiga et al. (2009), are similar to the results of our study where the highest number of cases of all reproductive pathological conditions was recorded in the group of animals between 5 and 10 years of age (38%), while 28% of all reproductive disorders occurred in dogs older than 10 years. In female dogs, besides mammary gland tumors, the most commonly reported tumors are those of the uterus or vagina (Veiga et al., 2009). In our retrospective study, no uterine tumors were reported, while ovarian tumors and TVT, which invades the vaginal mucosa and is one of the most common vaginal tumors in tropical regions and developing countries, were reported (Ortega-Pacheco et al., 2007; Galić et al., 2019). Vaginal and vulva neoplasms account for 2.4% - 3% of all tumors in dogs and most of them are benign (McEntee, 2002). Vaginal prolapse (5 cases were recorded in our study) and clitoromegaly in hermaphroditism (one case was recorded in our study) can be mixed with vaginal tumors, so great attention should be taken in their final diagnosis (Ortega-Pacheco et al., 2012). The most commonly reported tumors in male dogs are tumors of the testicles, foreskin, and prostate (Veiga et al., 2009). However, only two testicular tumors were reported in this study. A study obtained in year 2022, conducted by the authors on ten dogs (Spasojević et al., 2022), showed that bilateral cryptorchidism occurred in 20%, while unilateral cryptorchidism was recorded in 80% of patients, while in one dog, a seminoma type of testicular tumor subsequently occurred after the primary diagnosis of undescended testicle. This study did not distinguish types of cryptorchidism, but of all pathological changes,

cryptorchidism occurred in 14% of cases and was the most common pathological condition of male individuals in this study.

Hypospadias, an abnormal position of the urethral opening, is considered a rare congenital malformation of the male reproductive organs of dogs. In a retrospective study from a veterinary clinic in Poland (2006-2017), a total of 10 cases of penile hypospadias (0.05%) were reported, when reviewing 19,950 medical records of male dogs (Switonski et al., 2018). In the review of this study, one case of hypospadias was reported in two years at the Veterinary Clinic of the Faculty of Agriculture in Novi Sad.

The risk of developing pathological processes in the ovaries increases proportionally with the age of the bitch, which raises the question of the optimal age of the bitch for gonadectomy (Bostedt et al., 2013). Residual ovary syndrome is an iatrogenic condition that occurs when an error occurs in tying the ovaries during oophorectomy or ovariohysterectomy (Wallace, 1991). Also, ovarian tissue can fall out into the abdomen of the bitch during this surgical procedure, and the ovarian tissue can remain active (Terazono et al., 2012). In addition to ultrasonography, which is not always the safest method (Sontas et al., 2007), measuring the activity of estradiol and progesterone provides a clearer picture of the diagnosis of this syndrome (Ortega-Pacheco et al., 2012). In a study of three clinics in the United States (Ball et al., 2010) over a seven-year period (2000-2007), only nineteen dogs with residual ovary syndrome were reported, while in this study, a review of medical records over a two-year period recorded one case of residual ovary syndrome. Anovulatory functional follicular ovarian cysts are common incidental findings in older bitches, especially those that have never been mated or have not had a litter, and may be solitary or multiple (Schlafer and Miller, 2007; Ortega-Pacheco et al., 2012; Stančić, 2012). In a study done in year 2017 (Maya-Pulgarin et al., 2017), conducted on 3,600 bitches that underwent ovariohysterectomy, 10.5% of follicular cysts were reported, while in this study only two (2%) ovarian cysts were found.

A more recent study from 2021 reported 13.2% mastitis in bitches (Lection et al., 2021), while in this study mastitis occurred in 5% of cases. On the other hand, a disease directly related to the mammary gland of bitches is pseudopregnancy. Clinical symptoms range from mild udder enlargement and lactogenesis to the appearance of clear signs of true pregnancy with the manifestation of parturition, nest building, loss of appetite, apathy, emotional attachment to some immovable objects and strong lactation (Stančić et al. 2012a), and an incidence of 4.43% (Dhurvey et al., 2022) while the incidence in our study was 13%. In small practice, pyometra is one of the most common uterine diseases in bitches. The incidence of pyometra increases significantly after the age of 5, but younger bitches can also be affected. In addition to the age of the bitches, the breed also has a significant influence, as does the season (Stančić et al., 2008; Stančić et al., 2012b). In this study, 10% of cases of pyometra were recorded, which, in addition to 2% of cases of hematometra, were the only cases of pathological uterine conditions. In a retrospective study that included 599 dogs, the authors report that 79 dogs (13.2%) developed pyometra during their lifetime, and 160 (26.7%)

developed mammary gland tumors (Beaudu-Lange et al., 2021), which is in line with the results of this study, where pyometra occurred in 9 cases (10%) and mammary gland tumors in 24 cases (26%).

Neonatal diseases and puppies losses are a common and unavoidable problem in veterinary practice. Morbidity and mortality range, according to the literature, from 5 to 35% (Münnich and Küchenmeister, 2014). In this retrospective study of neonatal disorders, only puppies deaths (deformities, anasarca and gastroschisis) could be noted, which was recorded in 5% of cases. Among non-infectious causes, in addition to hypoxia during birth, hypothermia, hypoglycemia and dehydration are most responsible for diseases and puppies losses in the first days of life, so ultrasound assessment of pup vitality during maternal pregnancy is very important in veterinary practice (Pereira et al., 2022; Galić et al., 2022).

CONCLUSION

The traditional approach to treating reproductive disorders in dogs used to involve ovariohysterectomy or orchiectomy. Nowadays, the various pharmacotherapeutic groups are much broader for specific problems related to canine reproduction, but on the other hand, surgical techniques for the repair of various disorders are still the only way to eliminate many pathological conditions in canine reproduction. Overall, the problems that most often occur in veterinary practice, and relate to the pathology of canine reproduction, remain the same for a long period of time. The positive effect in such disorders is found in quick and easy diagnosis, but also in modern methods for their correction.

Conflict of interest statement: The authors declare that there is no conflict of interest.

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