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Urinary incontinence due to estrogen deficiency in dogs

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ABSTRACT

Nowadays, various methods are used to control reproduction in domestic animals. The most commonly used method is ovariohysterectomy, in which the ovaries and uterus are removed together. In this review, an overview will be made of urinary incontinence due to estrogen deficiency, which is one of the complications that may occur after this operation, which is performed in almost every clinic, and which can negatively affect the life of the patient and the patient's relative. The exact mechanism involved with this condition is not yet fully understood but estrogen deficiency with a subsequent loss of urethral tonus is believed to trigger clinical signs. Also, information about the risk of urinary incontinence in animals that have undergone early ovariohysterectomy will be given.

Keywords: urinary incontinence, ovariohysterectomy

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Introduction

Definition

Urinary incontinence can be briefly defined as involuntary urination or incontinence. The condition, which is mostly observed as the animal wetting itself while sleeping, can also be observed at different times and positions such as running, jumping, coughing or barking, sitting position (Tektepe, 2019).

While the risk of urinary incontinence in unneutered dogs is less than 1%, in neutered dogs the risk varies between 5% and 20%. In some breeds, this rate can be as high as 60%. Urinary incontinence usually occurs on average 2-5 years after neutering. However, symptoms can also occur up to 10 years after neutering or immediately after the operation. (Reichler and Hubler, 2014).

The operation procedure, whether it was ovariectomy or ovariohysterectomy, had no effect on the incidence of urinary incontinence or the time interval between the occurrence of urinary incontinence after sterilization (Stöcklin-Gautschi et al., 2001).

As a result of the study (Tektepe, 2019) it was determined that decreases in urethral sphincter pressure were observed within a year following the operation and when this pressure fell below the critical level, urinary incontinence complication was observed. In the study conducted by Trusfield (1985), the link between sterilization and urinary incontinence was proven. It is suggested that it occurs as a result of neurological, vascular, and hormonal changes that occur after sterilization, rather than mechanical damage to the lower urinary tract during sterilization.
There are multiple factors involved in the etiology of urinary incontinence (Thrusfield, 1985). The probability of urinary incontinence in neutered dogs varies according to body weight. The probability of occurrence in neutered dogs with a body weight of less than twenty kilograms was 9.3%, while this rate was determined as 30.9% in dogs with a body weight of more than twenty kilograms. Breed predisposition should also be considered in urinary incontinence cases. While the rate of urinary incontinence in boxer

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dogs was 65%, this rate was found to be 10.6% in German shepherd dogs (Arnold et al., 1989). The probability of urinary incontinence was highest in female dogs spayed before the age of three months. According to the data collected in the study, the probability of urinary incontinence in the first six years of life was 12.9% in dogs spayed before the age of three months, while this rate was 5% in dogs spayed after three months of age (Spain et al., 2004). Although the advantages of neutering before the age of six months are defined as the ease of the operation, less postoperative trauma in young dogs, prevention of unwanted pregnancies, and decreased risk of mammary tumours, there is no significant association between early spaying and incontinence found in a study conducted by Bleser at al. (2011). Incontinent neutered bitches present lower levels of gonadotropins than continent neutered bitches, creating the hypothesis that a low endogen GnRH production is involved in incontinence. Although the mechanism is still unclear (Jesus et al., 2020). Estrogen receptors presence in the inferior urinary tract has been demonstrated, and such receptors can be detected in the vesical trigone, in the urethra and in the connective tissue around it (Batra and Iosif, 1983). Which justifies the deleterious effects on the urinary tract of bitches post-neutering with the reduction of circulating estrogen (Jesus et al., 2020). Since urinary incontinence is a condition that requires lifelong treatment and brings discomfort to the patient's relatives, all factors should be taken into consideration to choose the optimum period for sterilization (Bleser et al., 2011).

Some changes occur in the urinary bladder after sterilization. The changes are listed below.

1. Changes in the urinary bladder after neutering

1.1. Response to Muscarinic Stimulation: The response to muscarinic stimulation in the urinary bladder was lower in gonadectomized animals than in non-gonadectomized animals, irrespective of age, weight, and sex. The neurogenic response in the urinary bladder parallels the muscarinic response and also does not vary with age, weight and sex. It is significantly reduced in gonadectomized animals compared to non-gonadectomized animals (Coit et al., 2008).

1.2. The amount of collagen in the urinary bladder wall: The amount of collagen in the urinary bladder wall is also among the findings that change after gonadectomy. Collagen deposition increased significantly in the urinary bladder after ovariohysterectomy. Accumulated collagen accumulates between the muscle bundles, changes the structure of the bladder, and predisposes to urinary incontinence (Coit et al., 2008; Ponglowhapan et al., 2008). In the study conducted by Ponglowhapan (2008) gender differences were found in all four regions of the lower urinary tract in intact dogs but only in proximal urethra in gonadectomised dogs where spayed females had a higher proportion of collagen and less muscle. Excessive collagen deposits and less muscular volume may impair structural and functional integrity of the lower urinary tract which may associate with the development of post-neutering urinary incontinence in the dog (Ponglowhapan et al., 2008).

1.3. Urinary bladder glucosamine amount: It has been reported that the amount of glucosamine in the urinary bladder and urethra decreased in gonadectomized rodents due to gonadal hormone deficiency (Cabral et al., 2003). Similarly, a decrease in the amount of glucosamine in the tissues of the lower urinary tract has been reported in premenopausal and menopausal women (Bezerra et al., 2004). These observations in both species suggest that the glucosamine content in the lower urinary tract is regulated by the endocrine system and that altered glucosamine composition is associated with the development of urinary incontinence (Ponglowhapan et al., 2011). The study conducted by Ponglowhapan (2011) demonstrated the effect of gonadal status on the glycosamine profile in the lower urinary tract of dogs. The decrease in glycosamine composition in the lower urinary tract of gonadectomized dogs indicates the effect of gonadectomy on glucosamine metabolism.

Disorders in the urethral sphincter mechanism and their causes should also be considered in cases of urinary incontinence.

2. Causes of urethral sphincter mechanism incompetence (USMI)

Urethral incompetence is the most common cause of incontinence in adult female dogs (Adams, 2010). Adhesions at the bladder neck and vaginal-uterine adhesions, anatomical or neurologic damage, shortening of the urethra, caudal positioning of the bladder, hormonal changes after ovariohysterectomy, body size, race, presence of obesity, and tail docking can be listed as causes (Gregory, 1994). Holt and Thrusfield (1993) demonstrated a link between tail docking and urethral sphincter mechanism deficiency.

Since predisposition to urethral sphincter mechanism failure was observed in breeds with urinary incontinence after ovariohysterectomy and in breeds that routinely undergo tail docking, further studies are needed to explain the link between these conditions. (Bleser et al., 2011). Estrogen deficiency in spayed females is believed to lead to a type of urinary

incontinence known as "urethral sphincter mechanism incompetence" (USMI), which involves not only the urethra smooth muscle but submucosa vasculature and urothelium, culminating in urethra insufficient closure (Jesus et al., 2020). When the collagen content of periurethral tissues was measured after ovariohysterectomy, no significant change was observed in the amount of collagen in the periurethral tissues of unspayed and sterile dogs (Forsee et al., 2013).

3. Urinary incontinence treatment options

3.1. Using alpha-agonist agents: Phenylpropanolamine prevents involuntary contractions by acting on adrenergic receptors in the smooth muscles of the urethral sphincter with sympathomimetic effect. In this way, involuntary urine output is prevented. Blood pressure should be monitored at the beginning of treatment to eliminate the risk of high systolic blood pressure, one of the possible side effects of phenylpropanolamine. It should be used with caution or should not used at all in patients with heart problems after a general cardiac examination (Byron, 2018).

Blood pressure measurements should be performed regularly within 2-4 weeks after the start of treatment. Other side effects of phenylpropanolamine include restlessness, aggression, decreased appetite, and insomnia. These side effects disappear when the dose is reduced or treatment is discontinued. (Byron, 2018) Phenylpropanolamine dosage; 1-1.5 mg/kg 8h or 12h PO (Chew, 2011)

3.2. Estrogenic agents: Estrogenic agents such as estriol increase the sensitivity of alpha-adrenergic receptors in the urethral sphincter to catecholamines. Applying alpha-agonist treatment together with estrogen treatment increases the success rate with synergistic effect between the drugs. In estrogen therapy, estriol, which does not accumulate in the body and is excreted through urine without being metabolized in the liver, should be preferred (Chew, 2011). Estriol is a short-acting estrogen derivative. The side effects caused by estrogen (estrous symptoms and behavior, depression, pyometra) are not seen in estriol treatment. In a study conducted by Beceriklisoy et al. (2005), the treatment rate of urinary incontinence with estriol was reported to be 80% (Beceriklisoy, 2005). The recommended dose is reduced after improvement by 0.5 mg per week until the minimum effective dose is reached, which can be continued every other day. If no response to treatment is achieved after the first two weeks, it may be beneficial to continue dosing 2 mg/dog until clinical improvement is appreciated (Timmermans et al., 2019).

3.3 Combination therapy: If there is no response to phenylpropanolamine or estriol treatment or if relapse is observed, treatment with combined phenylpropanolamine and estriol is given. For dog's combination therapy, urodynamic evaluation is recommended. If urethral sphincter incompetence is diagnosed; injection of urethral bulking agents or surgical methods to increase urethral resistance applied (Adams, 2010).

3.4. Artificial urethral sphincter: Artificial urethral sphincter works by acting as a silicone cuff sphincter placed around the urethra. The cuff inside the artificial sphincter is adjusted by the operator to hold the urine during bladder filling, but to allow urine to pass out when a certain level of fluid pressure is reached. This treatment method can be used as an alternative in drug-insensitive patients, but its applicability is still in the framework of research as it requires a specialized operator (Rose et al., 2009).

3.5. Injection of urethral bulking agents: Bulking agents (glutaraldehyde cross-linked collagen) are applied to the proximal urethra as submucosal injection. In veterinary medicine, components containing bovine collagens are used for bulking. These agents, which lengthen the length of muscle fibers by acting as central padding, increase urethral bulging. Urethral bulging improves control of incontinence. The disadvantage of this application is that it requires repetition because of the agents used in the injection do not have a lifelong effect. The agents used are effective for 17-21 months. The fact that the application is easy and minimally invasive shows that it can be used as a treatment alternative in dogs resistant to medical treatment (Butty et al., 2018).

Conclusion

Although the etiologic origins of urinary incontinence in dogs are still unclear, the incidence of urinary incontinence increases after ovariohysterectomy. Also while the advantages of prepubertal ovariohysterectomy have been frequently discussed in the academic world recently, lifelong complications such as urinary incontinence should be mentioned and should be considered as a serious complication after sterilization. While treatment options for urinary incontinence vary, the most used techniques are the usage of alpha-agonist agents, the usage of estrogen or using them both as combined treatment. In recent years, with the development of veterinary surgical procedures and research on urogynecology, the rate of resolution of urinary incontinence cases has increased rapidly.

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