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Canine cryptorchidism: An overview

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Abstract

Cryptorchidism is an inherited, autosomal recessive condition in dogs. Breeding animals with this ailment is discouraged due to the risk of the problem being passed to progeny. Cryptorchidism is particularly prevalent in smaller breeds and purebred dogs, including the English bulldog, Boxer, Chihuahua, Shetland sheepdog, Siberian husky, and Yorkshire terrier, with a reported incidence rate ranging from 0.8 to 10%. This paper provides an overview of canine cryptorchidism including its causes, diagnosis, and therapy.

Keywords: Breeding, cryptorchidism, dog

Introduction

Under normal circumstances, Anatomically a male dog's scrotum should contain two easily palpable testicles. The term 'cryptorchid' refers to a congenital condition that occurs when one or both testicles do not descend from the abdomen into the scrotum (Rezaei *et al.* 2016)^[17]. When neither testis descends, the condition arises known as bilateral Cryptorchidism whereas only one testicle descended in a unilateral cryptorchid, with the other remaining lodged somewhere in the belly, the inguinal canal, or the prescrotal region (khan *et al.*, 2018)^[10]. In dogs, cryptorchidism is an autosomal recessive trait, which means that either the dam or the sire might carry it and pass it on to the progeny (Bufalari *et al.*, 2015)^[2]. Because of this, it is not advisable for dogs with this anomaly to breed since they may pass it on to their progeny. Smaller breeds are 2.7 times more likely than larger breeds to suffer cryptorchidism (Yefimova *et al.*, 2019)^[24] and are one of the most common congenital disorders seen in small animal medicine. The reported frequency of cryptorchidism ranges from 0.8 to 10 % (Cortes *et al.*, 2003)^[3]. Moreover, some breeds (English bulldog, the Boxer, Chihuahua, Shetland Sheepdog, Siberian husky and Yorkshire terrier) have shown a higher incidence of cryptorchidism and are therefore more susceptible to developing it (Tekant *et al.*, 2001). Depending on the location of the retained testis, a range of surgical methods may be selected effectively. Critical complications (spermatic cord twisting, Neoplasia hormonal changes) can occur as a result of the condition (Tapia Araya *et al.*, 2015)^[20] and are dependent on various factors associated to the retained testicle (s), such as the Animal's age and the location of the retained testicle (Amann and Veeramachaneni 2007)^[14].

Development

A variety of biological factors contribute to the development of cryptorchidism. Normal sexual development in male dogs necessitate the presence of sex chromosomes, normal development of the testicles, and normal development of the external genitalia under the influence of sex hormones including testosterone, luteinizing hormone, follicle stimulating hormone, or estrogen. The absence of any of these triggers the development of cryptorchidism in dogs (Veeramachaneni *et al.*, 2007)^[14]. The embryo's sex becomes recognizable after day 30 of gestation (Sharpe 2006)^[19]. In the normal dog, sex cords are the first structure to emerge near the kidneys, which will later on differentiate into either the ovaries or testes. In addition, the Y chromosome regulates a chemical referred to as the testis determining factor (TDF), which determines whether development is male or female (Yoshida *et al.*, 2005)^[25]. In males, testicular differentiation will begin after day 36 of gestation and development has been

determined by these genes and chemical. (Felumlee *et al.*, 2012) ^[6]. After initial development, the testes will be located near the kidneys in the Abdominal cavity beneath the peritoneum, with the right testicle somewhat cranial to the left (Rezaei *et al.*, 2016) ^[17].

The end of a testicle is connected to the gubernaculum, amesenchymal cord that passes through the inguinal canal the route between the deepInternal inguinal ring and the superficial external inguinal ring) and links to the growing scrotum (Ray and Grinson 2011) ^[16]. The vaginal process refers to the peritoneal evagination in the inguinal area (Hecht *et al.*, 2004) ^[7]. The gubernaculum passes through the vaginal process, forming the vaginal cavity. When particular peptide hormones are triggered, the gubernaculum expands to apply pressure to the testes thus keeping them in place throughout the process of testicular descent. Normal testicular descent starts as testosterone stimulates the development of the genitofemoral nerve, which innervates and differentiates the gubernaculum (Amann and veeramachaneni 2007) ^[14]. As the gubernaculum grows, it causes an expansion of the inguinal canal, which pulls the testis and epididymis towards the scrotum until the testicles have moved through the inguinal canal and the gubernaculum responds by shrinking while the testes settle into their final position in the scrotum. The genitofemoralnerve, that runs through the gubernaculum, will be stimulated to shrivel and regress as the testicles descend. In a nutshell under normal circumstances testicular descent takes place when the testes travel through the abdominal cavity and into the deep inguinal ring, then through and ultimately out of the inguinal canal, wherethey move into their final scrotal position.

Diagnosis

A physical and visual examination are both helpful to diagnose cryptorchidism and locating the retained testicle. Careful palpation of the scrotum and the region of the inguinal canal can be an accurate sign but it is important not to confuse with fat or a lymph node with a retained testicle, which is extremely common (Dogra *et al.*, 2003) ^[5]. A testicle should be able to move freely and have a palpable epididymis attached to it Ultrasonography is one method of locating the retained testis, although it might be difficult depending on whether the testicle is in the inguinal canal or the abdomen (Vijjan *et al.*, 2004) ^[23]. If the testicle is in the abdomen, it may be smaller in size and located in a wider variety of regions of the abdominal cavity, making ultrasonography more effective in locating inguinal retained testicles. If an ultrasound can successfully find a testicle retained in the belly, it should have a scrotal testis-like structure, unless there are difficulties (Ras *et al.*, 2010) ^[15].

If ultrasonography fails or the testicle(s) cannot be palpated, another alternative is to perform an HCG or GnRH stimulation test. This test will detect the presence of testicular tissue, which is an obvious sign of a retained testicle (Hutson *et al.*, 2009) ^[8]. This test involves measuring a baseline testosterone level and then injecting a stimulating hormone, such as HCG 250 IU S/C (Total dose) or GnRH @ 2.2 µg/kg I/M (Pekkafali *et al.*, 2018) ^[13]. Testosterone concentrations are subsequently measured at 1 and 4 hours post injection. If the baseline testosterone concentration exceeds double, it is apparent that the animal contains testicular tissue. It is worth noting that cryptorchid males exhibit a less evident reaction to an HCG or GnRH stimulation test than males with successful testicular descent (Bhuvaneshwari and Begum 2018) ^[1]. It is also noteworthy to note that, while it has been considered,

there has been no sign of any absence or excess of hormone levels, such as testosterone, luteinizing hormone, follicle stimulating hormone. Furthermore, there is an occasional incidence of the anxious individual retracting their testes against their body when handled, and in this situation, massaging the inguinally held testes towards the scrotum might be conducted (Rezaei *et al.*, 2016) ^[17].

Treatment

Cryptorchidism is best treated surgically by removing both testes. If the animal is a unilateral cryptorchid, one descended testis will most likely be capable of producing sperm. (Kennedy and Fransson 2015) ^[9]. But it induces morphological changes and hyperplasia of testes. The surgical approach for identifying and removing the retained testicle is affected by its location. In order to locate the retained testicle, the ductus deferens must be identified and tracked to the testicle, which may be retained abdominally or inguinally. If the ductus deferens may be seen going through the inguinal ring, the testis is not abdominal. Once the retained testicle has been located, a variety of incisions can be performed based on its position. These are described further below. The retained testicle can be removed laparoscopically, via a laparoscopic-assisted operation, or through particular incisions (Schambourg *et al.*, 2006) ^[18]. In the case of inguinal or pre-scrotal retained testes, a standard castration incision will be used to remove them. If the testis is abdominal and has moved away from the typical midline incision, the surgical strategy will be to cut directly across the retained testicle (MacKinnon 2005) ^[11]. The most common incisions used for abdominal testicle removal are a Pre-preneputial skin incision and a paramedian abdominal wall incision, respectively (Daghighi *et al.*, 2006) ^[4]. The paramedian abdominal wall incision has been proven to be the least desirable approach since it is messy due to muscle hemorrhage and provides restricted access to the abdomen (Schambourg *et al.*, 2006) ^[18]. A. parapreputial skin incision with a midline abdominal wall incision is favored since it reduces bleeding and improves visibility, albeit with more tissue dissection required. This mid line incision can be prolonged to locate the testis if it is difficult to identify, as an abdominally retained testicle can be found anywhere between the kidneys and the inguinal ring (Madureira *et al.*, 2017) ^[12]. Performing this prolonged incision will result in less tissue stress. Most significantly, it is crucial to confirm that the structure that has been discovered and will be ligated and removed is the retained testicle and not another abdominal tissue (Schambourg *et al.*, 2006) ^[18]. Finally, surgical insertion of the retained testicle in the scrotum is not indicated, and surgery should not be undertaken in dogs under six months old in the case of late descent.

Conclusion

Cryptorchidism is an early indication of underlying testicular dysgenesis. Precise terminology is essential for recognizing and understanding the three stages of testis descent. The genitofemoral nerve secretes the chemo attractant calcitonin gene-related peptide, which provides directional guidance (testosterone dependent). The incidence of cryptorchidism is likely to be higher in companion animals or pigs than in cattle and sheep. In dogs and horses, a retained testis is usually abdominal. Noncryptorchid siblings might show similar testicular dysgenesis. Although cryptorchid males are at a higher risk of developing testicular cancers, non-cryptorchid males do as well. Veterinarians should be aware that

accidental ingestion of a pregnant dam to estrogenic or anti-androgenic drugs can result in testicular dysgenesis.

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