Management of partial obstruction of ejaculatory ducts in stallions: etiology, diagnosis, and treatment
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Abstract
Fertility problems in stallions have a variety of causes. Despite decades of clinical investigations, many of these causes still remain unknown. Therefore, treatment often is symptomatic rather than causative, and rarely leads to complete and permanent cure of the problem. This paper describes etiology, diagnosis and treatment of one of the little known disorders in stallions, which may have a significant impact on stallion’s breeding career.

Keywords: Stallion, fertility, ejaculatory duct, obstruction, utriculus masculinus

Introduction
Partial obstruction of the ejaculatory ducts is an under-diagnosed disorder in stallions, which causes a variety of clinical signs, and affects their fertility. More frequent use of high-resolution transrectal ultrasonography (TRUS) in recent years resulted in recognition of this condition in stallions with fertility problems. There is no one pathognomic sign of partial obstruction of the ejaculatory ducts in stallions, which makes this disorder very challenging to diagnose. Furthermore, the pathogenesis of partial obstruction of the ejaculatory ducts, and the impact of this disorder on stallions’ fertility are not very well understood. Therefore, this paper discusses the anatomy of the ejaculatory ductal system, as well the symptomatology, semen characteristics, and TRUS findings in stallions with a presumptive diagnosis of partial obstruction of ejaculatory ducts.

Anatomy
The vas deferens in stallions travels from the tail of the epididymis to the ejaculatory duct. After entering the abdominal cavity, it turns backward, and runs towards the pelvic cavity. It is attached to the lower part of the lateral wall of the pelvis by the urogenital fold. The vas deferens is freed from the urogenital fold at the level of the neck of the bladder, where both vasa lie very close together, separated by a very narrow space, or by the remnant of the Müllerian duct, often called uterus masculinus (Figure 1). Furthermore, the vasa are flanked laterally by the necks of the vesicular glands. All these structures dive underneath the isthmus of the prostate, travel to the caudal edge of this gland, and continue through the wall of the urethra. Each vas deferens joins the excretory duct of the collateral vesicular gland under approximately 50° to form ejaculatory duct, which opens on the summit of the urethra, called colliculus seminalis. In some instances (approximately 15% of stallions) the vas deferens may open separately, just next to the excretory duct of the vesicular gland.

The vas deferens in stallions is a relatively thick tube with a narrow lumen with the exception of its thickened glandular part called ampulla ductus deferentis. The ampulla is formed where the vas deferens is curving backwards towards the pelvic cavity, just before the vas travels over the urinary bladder. It consists of the numerous tubulo-alveolar glands, which completely disappear once the vas passes the isthmus of the prostate and dips to the wall of the urethra. The average outside diameter of the glandless part of the vas deferens in the stallion is 6 mm, while the ampulla is approximately 20 mm thick, and 15–25 cm long. Initially, the lumen of the vas deferens is narrow between the epididymal tail and the ampulla (1.1mm–3.8 mm); significantly expands through the ampulla (9–18 mm), and becomes spiral, with multiple, ring-shaped protrusions. The lumen of the most terminal part of the vas deferens in stallions is narrow again (approximately 3 mm), with the average length of this fragment of the vas being 4.6 cm.

The ejaculatory ducts in stallions are short, thin-walled tubes, only 2–3 mm long, and 6–7 mm wide. This anatomy varies significantly from man, in which the ejaculatory ducts are long (1–2 cm) and narrow, which makes them prone to physical obstruction by various neighboring structures.
The colliculus seminalis often contains a rudimentary structure, called the utriculus masculinus, vagina masculina, sinus prostaticus Morgagni, or alveus urogenitalis Meckel (Figure 2).\textsuperscript{5} The utriculus masculinus in horses has a more complex origin than the uterus masculinus. While its cranial portion is a remnant of the Müllerian duct, the most caudal portion has histological features similar to the vagina and is derived from the urogenital sinus.\textsuperscript{6} This structure forms a prominent diverticulum on the colliculus seminalis, which may be 5–7 cm long, and opens between the orifices of the ejaculatory ducts.\textsuperscript{6} Occasionally it connects with the ejaculatory duct, or ends blindly.\textsuperscript{1}

**Etiologies**

Ejaculatory duct obstruction can be either congenital or acquired. The only congenital cause of this disorder in stallions described to date is a utricular cyst, also called the midline cyst of the colliculus seminalis (Figure 2c).\textsuperscript{7} Acquired causes may be secondary to the formation of the thick gel plugs in the excretory ducts of the vesicular glands, which are later pushed into the ejaculatory ducts. Furthermore, calculi can be formed in the ejaculatory ducts, the excretory ducts of the vesicular glands, and in the terminal portions of the vasa deferentia. In men, trauma, infectious, or inflammatory causes have been described.\textsuperscript{8}
Utricular cysts, even though they have a congenital origin, may change in size and character of the epithelium due to the various levels of hormonal stimulation during puberty, the breeding season, or the aging process. Therefore, the impact of this structure on the ejaculatory process is not consistent and may vary during the lifespan of the animal. Large utricular cysts occupy the major portion of the colliculus seminalis and directly compress the structures which are traveling through the colliculus seminalis to the ejaculatory orifices. Ejaculatory ducts are especially vulnerable since they have thin walls and can collapse easily. On the other hand, however, even severe compression rarely completely obliterates their lumen due to the fact that they are wide and do not have a distinct sphincter.

The vesicular glands produce the gel portion of the ejaculate in stallions. The consistency of this last fraction of the ejaculate varies between individual animals and may be liquid, slightly gelatinous, or very thick and tapioca-like. Furthermore, the character of the gel portion may change in each individual stallion depending on the exposure to mares, social status, and frequency of ejaculation. Prolonged exposure of stallions to mares, without an opportunity to ejaculate, contributes to the accumulation of the large amounts of gel in the vesicular glands which thickens with time and forms thick plugs. These plugs can partially obliterate the ejaculatory ducts and affect the ejaculatory process.

Occasionally, small calculi or very hard accumulations of spermatozoa and/or bacteria are formed in the ejaculatory ducts, vasa deferentia, or the excretory ducts of the vesicular ducts. There may be multiple, small accumulations, which have grid-like appearance, or just one or two larger structures. The pathogenesis of the formation of these accumulations is not yet known, especially when only bacteria are present, without any inflammatory cells.

**Clinical signs**

There is a whole spectrum of clinical signs associated with partial occlusion of ejaculatory ducts in stallions. These include periodic ejaculatory dysfunction, decreased force of ejaculation, low ejaculatory volume and sperm numbers, poor motility of spermatozoa, or hematospermia. Usually only one or two of these signs are expressed simultaneously in the affected individual. Some stallions may have periods of time when ejaculation does not occur despite multiple efforts alternating with periods when the ejaculatory process is normal. Sexual behavior is normal up to the moment just proceeding ejaculation, however urethral pulsations or tail flagging do not occur. Due to the partial occlusion of the ejaculatory ducts only small amount of semen or seminal plasma is voided to the pelvic urethra and the ejaculatory process is not triggered. The affected stallions continue thrusting, or may start thrusting again
after a short pause. Some individuals may have one to three urethral pulses and a small amount of ejaculate is expelled. However, the force of ejaculation is significantly decreased. This phenomenon is easily observed during semen collection with an open-ended artificial vagina.

Some stallions do not have any obvious ejaculatory dysfunctions, but the quality of semen is low which leads to decreased fertility or infertility. Motility of spermatozoa is affected most frequently in stallions with the physical findings consistent with partial obstruction of ejaculatory ducts. Sperm morphology is often normal, with the exception of increased sperm with cytoplasmic droplets. Furthermore, severe oligospermia is a typical feature of partial obstruction of ejaculatory ducts in stallions. The quality of semen may fluctuate without any obvious reason.

Hemospermia was also observed in some stallions with partial obstruction of ejaculatory ducts. This can be the only sign of this disorder, or it can accompany others such as ejaculatory dysfunction or poor semen quality. The amount of blood in semen varies, and can be either very small and barely noticeable or quite significant giving the semen a bright red color.

Clinical findings

Typically, stallions with suspected partial obstruction of ejaculatory ducts appear normal on physical examination of external genitalia. Testes have normal size, consistency, and ultrasound appearance. Epididymides usually appear normal on palpation and ultrasound evaluation, however, the epididymal duct can be somewhat distended, especially if there were numerous unsuccessful attempts to collect semen. Rectal palpation of the internal genitalia is rarely revealing. However, vesicular glands may feel enlarged, especially when a large amount of thick gel is accumulated in their lumina. Furthermore, ampullae are often prominent on palpation.

Transrectal ultrasonography findings are crucial in diagnosis of partial occlusion of ejaculatory ducts. Utricular cysts are readily visualized within the colliculus seminalis. They are usually anechoic, have oval, tear, spindle, or rectangular shapes (Figure 3). Some cysts have echogenic contents, which make them more difficult to detect using ultrasonography. Distended lumina of the vesicular glands or ampullae are also often seen on the ultrasound images. The contents of these glands is usually anechoic, but may become echogenic or even hyperechoic if the occlusion is severe and prevents normal ejaculation for a prolonged period of time (Figure 4). The presence of a large amount of hyperechoic contents in the vesicular glands in the absence of utricular cysts suggests accumulation of gel. Finally, small hyperechoic structures may be found in the ejaculatory ducts, the excretory ducts of the vesicular glands, or in the vasa deferentia. Occasionally, these structures are expelled during ejaculation. They may be non-cellular or contain large numbers of bacteria, spermatozoa and epithelial cells.

Urethroscopy is always performed in stallions with hemospermia. In the absence of penile pathology, urethral rents, or seminal vesciculitis, a bleeding utricular cyst should be considered. Oozing of blood from the utricular orifice may be visible during urethroscopy.
Figure 3. Ultrasound images of the utricular cyst.
   a. Position of a transducer  
   b. Oval-shaped cyst  
   c. Tear-shaped cyst

Figure 4. Ultrasound images of hyperechoic accumulation of gel in the vesicular glands in stallions.
   a. Position of a transducer  
   b. Hyperechoic contents in the excretory duct of the vesicular gland  
   c. Hyperechoic contents in the fundus of the vesicular gland

**Treatment**

There is no specific treatment for partial occlusion of ejaculatory ducts in stallions; however, this disorder can be successfully managed. An experienced team of skilled people should work with stallions with this problem.

If the utricular cyst is compressing the ejaculatory ducts, the process of emission is significantly affected and the ejaculatory threshold cannot be reached. In order to assure that the adequate volume of fluid is voided into the urethral lumen during emission, the effected stallion should have a chance to produce enough semen and seminal plasma. Therefore, the number of natural breedings or semen collections should be limited, and teasing should be prolonged. In addition, strong stimulation during semen collection may help in reaching the ejaculatory threshold. Surprisingly, manual massage of the ampulae per rectum before ejaculation is often ineffective. However, pre-treatment with oxytocin (20 IU, iv, immediately before ejaculation) seems to enhance the chance for success. In addition, imipramine hydrochloride can be given (1200 mg, per os, two hours before ejaculation), in order to lower the
ejaculatory threshold. Interestingly, a successful ejaculation does not improve the chance for another ejaculation to occur.

The accumulations of thick gel in the vesicular glands need to be expelled in order to improve ejaculatory process in affected stallions. Manual trasrectal massage of the vesicular glands towards the colliclus seminalis, as well as treatment with oxytocin is helpful in expulsion of this gel. The volume of these accumulations may be massive. Therefore, multiple ejaculations are often necessary to completely remove the contents of the vesicular glands. The affected stallion should be placed on a regular schedule of ejaculation which will prevent future problems.

Expulsion of calculi or hard accumulations of spermatozoa and bacteria require strong stimulation and manual trasrectal massage of the ejaculatory apparatus; oxytocin treatment is often applied as well. Currently, there are no data on possible re-occurrence of this problem.

Conclusions

Partial obstruction of ejaculatory ducts in stallions occurs rarely, but may be very frustrating. It arises from several different causes, and is associated with a variety of clinical signs. To date, there is no permanent treatment for this disorder, but if properly recognized, it can be managed successfully.

A similar disorder is well known in human patients. A variety of treatments which result in a permanent cure are available. The effectiveness of these treatments in stallions should be explored.

References