



Journal of Equine Veterinary Science

journal homepage: www.j-evs.com



Original Research

Midline Cysts of Colliculus Seminalis Causing Ejaculatory Problems in Stallions

Malgorzata A. Pozor DVM, PhD, Dipl ACT^a, Margo L. Macpherson DVM, MS, Dipl ACT^a, Mats H. Troedsson DVM, PhD, Dipl ACT, ECAR^c, Claudia Klein DVM, PhD, Dipl ACT, ECAR^c, Mohamadou Diaw DVM^a, Claus Buergelt DVM, PhD, Dipl ACVP^b, Liane Dillon^a

^a Department of Large Animal Clinical Sciences, College of Veterinary Medicine, University of Florida, Gainesville, FL

^b Department of Infectious Diseases and Pathobiology, University of Florida, Gainesville, FL

^c Department of Veterinary Science, University of Kentucky, Lexington, KY

ARTICLE INFO

Article history:

Received 4 March 2011

Received in revised form

03 May 2011

Accepted 8 June 2011

Available online 27 July 2011

Keywords:

Midline cyst

Utricle

Uterus masculinus

Ejaculatory dysfunction

Stallion

ABSTRACT

Cystic structures are often seen during ultrasound examination of the internal genitalia of stallions. They are located between the ampullae of deferent ducts, either within the urogenital fold, or under the isthmus of the prostate (uterus masculinus). Occasionally, cystic dilatations are also found more caudally, behind the prostate, at the colliculus seminalis (urethral cyst, utriculus masculinus). These cysts are detected less frequently during routine examinations, possibly because of the fact that this area is screened less carefully for the pathologies than the more proximal portion of the internal reproductive tract of stallions. We have recently noticed that many stallions with ejaculatory problems have large cysts at the colliculus seminalis. This article describes the typical clinical presentation of these cases, diagnostic procedures, and management. In addition, we discuss the discrepancies in the currently used terminology pertinent to this condition, as well as introducing a new term, which seems to best describe the root cause of this disorder. Finally, this article presents new diagnostic and therapeutic options used in human medicine in similar cases, and proposes to investigate the applications of these methods in veterinary medicine.

© 2011 Elsevier Inc. All rights reserved.

1. Introduction

Ejaculatory dysfunctions in stallions occur rarely but are frustrating for horse breeders [1]. Various musculo-skeletal and neurologic diseases are responsible for the majority of these disorders, whereas only a small percentage of them is associated with the ejaculatory apparatus itself [1,2]. Diagnosis of specific causes of these dysfunctions is difficult and often unrewarding. Dilatation of the terminal portion of the ampullae of deferent ducts, visualized during transrectal ultrasound evaluation (TRUS), is often reported in cases of ejaculatory

dysfunctions that are associated with partial or complete occlusion of the ampullae [3].

Uterus masculinus, which is a cystic remnant of the Müllerian ducts, has been occasionally associated with ejaculatory problems in stallions [4]. However, this structure is also identified in stallions with normal ejaculatory patterns [5,6]. It is most often located between the terminal parts of the ampullae of deferent ducts, within the urogenital fold, on the dorsal side of the bladder; or on the level of the neck of the urinary bladder, underneath the prostatic isthmus (Fig. 1A). A small lumen is often present in the mid-portion of this structure, which can be identified in many stallions during a routine ultrasound evaluation. Secretions of the glandular epithelium may become trapped within this lumen and may form cysts of various sizes and shapes (Fig. 1B). Anterior part of the uterus masculinus often gives

Corresponding author at: Malgorzata A. Pozor, DVM, PhD, Dipl ACT, University of Florida, College of Veterinary Medicine, PO Box 100136, Gainesville, FL.
E-mail address: pozorm@ufl.edu (M.A. Pozor).

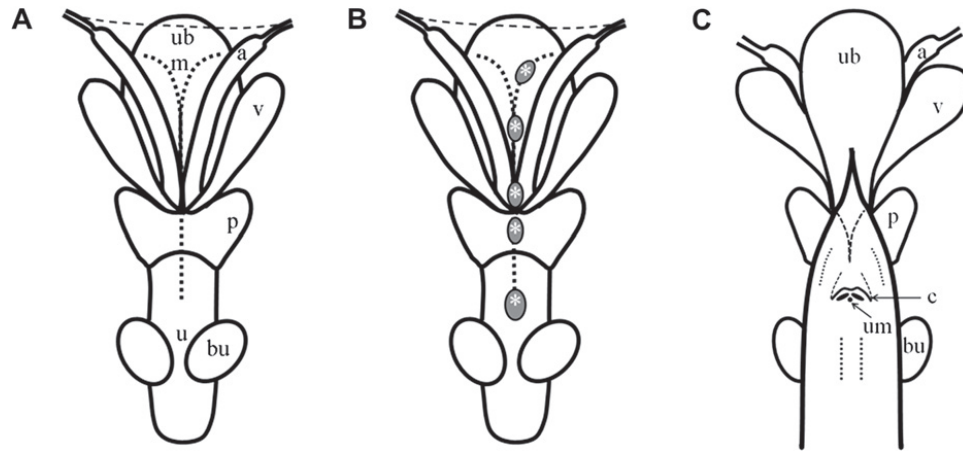


Fig. 1. Internal genitalia in stallion (ub = urinary bladder, a = ampulla of deferent duct, v = vesicular gland, p = lobe of prostate, bu = bulbourethral gland, u = urethra, m = uterus masculinus, c = colliculus seminalis, um = opening to utriculus masculinus, * = cyst). (A) Dorsal view. (B) Various locations of cysts. (C) Ventral view with the urethra cut open.

off two cornua with blind ends. The posterior end, called utriculus masculinus, continues its course beyond the prostate, and opens into the urethra on the summit of the colliculus seminalis (Fig. 1C). Lack of this opening may lead to the formation of a cyst at the colliculus seminalis, called prostatic utricle, cystic enlargement of utriculus masculinus, or urethral cyst (Fig. 2A) [4,7]. Large cysts at this location may interfere with emission and the ejaculatory process in some stallions (Fig. 2B) [6]. Significant compression of the ejaculatory ducts (EDs) leads to a build-up of fluids in the ampullae of deferent ducts and in the excretory ducts of the vesicular glands. Small cellular concretions or large solid plugs form in the very terminal parts of deferent ducts as a consequence of a long-term spermiostasis (Fig. 2C). Gel secreted by the vesicular glands becomes very thick, difficult to expel, and may completely plug the EDs.

We have recently examined 10 stallions with cysts at the colliculus seminalis, which contributed to the long-term problems with the ejaculatory process (Table 1). These cysts were located between the caudal edge of the prostate and the cranial pole of the bulbourethral glands, at the level of the colliculus seminalis. The affected stallions showed a similar pattern of copulatory behavior, and similar physical features in their internal reproductive tract. Therefore, in this article, we describe this disorder as

a separate clinical entity, which deserves recognition by practicing veterinarians.

2. Presentation

Typically, stallions with ejaculatory problems, associated with the midline cysts of the colliculus seminalis, present to the clinic with a complaint of inconsistent reproductive performance. They have periods with normal sexual behavior and good semen quality, alternating with days or weeks of ejaculatory problems and/or poor semen quality. Treatment with oxytocin and transrectal massage of the accessory sex glands only occasionally helps in obtaining an ejaculate, but these procedures are not effective on many occasions. Frequent semen collections do not prevent an occurrence of this disorder. There are also cases, which present with a consistent history of long-term ejaculatory problems or infertility.

3. Evaluation

Evaluation of stallions with ejaculatory disorders follows the outline of the breeding soundness evaluation recommended by the Society of Theriogenologists [8]. However, some modifications are usually made.

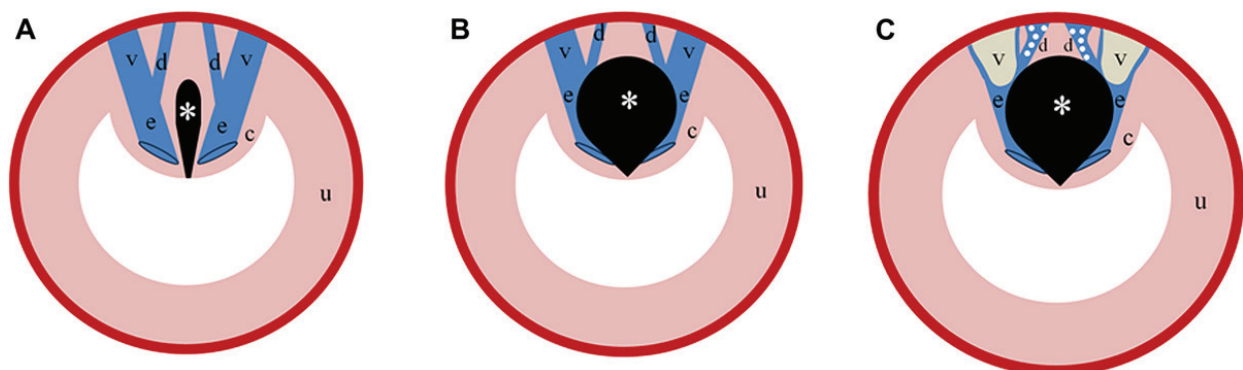


Fig. 2. Pelvic urethra (cross-section) at the level of colliculus seminalis in a stallion (u = urethra, c = colliculus seminalis, v = excretory duct of the vesicular gland, d = terminal part of deferent duct, e = ejaculatory duct, * = utriculus masculinus). (A) Diagram with normal utriculus masculinus communicating with a urethra. (B) Diagram with enlarged utriculus masculinus not communicating with a urethra (cyst of colliculus seminalis). (C) Diagram with a cyst of colliculus seminalis, dilated excretory ducts of vesicular glands with thick plugs, and terminal parts of deferent ducts with solid concretions.

Table 1
Clinical examples of stallions with the midline cysts of the colliculus seminalis

Case Number	Age Year	Breed	Presenting Complaint	Sexual Behavior	Semen Characteristics	Shape of a Cyst	Largest Dimension of a Cyst (cm)
1	13	TB	BSE	Ejaculatory difficulties	Normal	Oval	1.13
2	17	QH	Ejaculatory difficulties	Ejaculatory difficulties	Asthenozoospermia; bacterial plugs	Oval Spindle shape	1.0
3	10	QH	Occasional Asthenozoospermia	Occasional ejaculatory difficulties	Occasional Asthenozoospermia	Tear shape	1.5
4	5	Paso Fino	Short longevity of sperm motility	Strong stimulation necessary	Short longevity of sperm motility	Oval	1.5
5	13	Tennessee Walking Horse	Azoospermia, tailless heads	Ejaculatory difficulties; discomfort	Azoospermia, large percentage of tailless heads of spermatozoa	Oval	1.5
6	8	Miniature Horse	Ejaculatory difficulties	Ejaculatory difficulties	High concentration of spermatozoa; bacterial plugs	Oval	0.54
7	7	TB	BSE	Ejaculatory difficulties	Normal	Oval	1.13
8	4	Paint	Anejaculation	Ejaculatory difficulties	Normal	Oval and rectangular (multiple)	1.2; 0.9; 0.5
9	8	Irish Draft	Infertility	Anejaculation	Azoospermia	Tear shape	1.2
10	4	Paso Fino	Asthenozoospermia	Low libido; strong stimulation necessary	Oligospermia; Necrospermia	Oval	1.5

3.1. Sexual Behavior

After conducting a complete physical examination of the affected stallion, evaluation of sexual behavior is always performed. This can be done either in presence of an ovariectomized mare showing strong estrous behavior, or in a mare in natural heat. Strong teasing is recommended in cases of timid or novice stallions. Young, especially novice stallions, as well as some stallions with acquired ejaculatory problems require a longer precopulatory phase than older and experienced stallions [9]. If the stallion has a history of sexual behavior problems, washing the penis and taking penile swabs are deferred to future sessions so as to avoid any distractions.

Copulatory behavior is evaluated during semen collection or natural breeding. Each session is video-recorded to allow for detailed analysis of all aspects of stallion's behavior, as well as a technique of semen collection. A camera should be mounted on a tripod and set for recording the entire scene. We find information derived from the recorded material very helpful in the majority of cases. In addition, the specialists from other fields of veterinary profession, such as medicine or surgery, can view recorded sessions and give their opinion regarding the need to conduct neurological or lameness examinations.

Ejaculatory dysfunctions in stallions are often associated with musculoskeletal problems or with an occlusion of the ampullae of deferent ducts. However, stallions with these conditions display different behavioral symptoms than stallions with the midline cysts of the colliculus seminalis (Table 2). Stallions experiencing acute discomfort because of various musculoskeletal diseases show signs of pain, such as ear pinning, head throws, high pitch vocalization, and sudden dismounting. These behaviors occur early during the copulatory phase, whereas the specific ejaculatory problems are expressed later, during emission or ejaculation itself. Prolonged painful stimuli associated with the reproductive tract (stallion ring, etc.) affect libido [10], whereas stallions experiencing ejaculatory dysfunctions

associated with the midline cyst of the colliculus seminalis retain strong sexual drive despite their symptoms. Stallions with occluded ampullae thrust multiple times, and often show behaviors accompanying ejaculation, such as tail movements (flagging), or urethral contractions, but only seminal plasma is expelled under low pressure. They dismount slowly, and in the majority of cases do not show any signs of distress. Stallions with large midline cysts of the colliculus seminalis have a significantly higher number of pelvic thrusts during copulation than normal stallions. Because fluids from the ampullae and the vesicular glands are not voided during emission because of the physical obstruction, ejaculatory process is not triggered, and the affected stallion may start thrusting again after a short pause. They often stay mounted on a mare or a dummy without signs of relaxation, and finally slowly dismount. After prolonged thrusting, a stallion often moves his hindquarters sidewise, toward the artificial vagina handlers. Occasionally, affected stallions try to reposition themselves vigorously, tossing their head, moving their front end up with front feet on the neck of a mare. Special caution has to be taken while collecting semen from these stallions to avoid injury.

Multiple attempts to collect semen are often necessary to obtain a semen sample for evaluation. Strong teasing, application of hot compresses on a base of stallion's penis, and oxytocin treatment may enhance ejaculatory response.

3.2. Semen Evaluation

Parameters of semen collected from affected stallions are very variable. The most frustrating feature is inconsistency of semen quality. All semen parameters may be normal, but, more often, numbers of spermatozoa are low (oligospermia—azoospermia); motility of spermatozoa is severely affected, or spermatozoa are not motile (asthenozoospermia or necrospermia) (Table 1). The percentage of morphologically normal spermatozoa is often low. However, there are only a few spermatozoa with primary

Table 2
Behavior symptoms associated with various conditions causing ejaculatory dysfunctions

Behavior	Conditions		
	Musculoskeletal Pain	Occluded ampullae of deferent ducts	Midline cyst of colliculus seminalis
Libido	Normal initially; often worsens if pain symptoms experienced for a prolonged period	Usually unaffected	Unaffected
Ability to mount	May be severely affected	Unaffected	Unaffected
Copulatory phase	Shorter than normal	Longer than normal	Longer than normal
Pelvic thrusts	Lower number than normal	Greater number than normal (approximately, 8 to 10)	Greater number than normal (approximately 10 to 16); often another sequence of thrusts occurs after a short pause
Dismount	Sudden, immediately after last pelvic thrust	Slow, after a short pause following a last pelvic thrust	Very slow, after a long pause following a last pelvic thrust
Coupling posture	Poor coupling posture; straight back; shifting weight to one side	Normal; properly curved back	Normal; properly curved back
Other behaviors expressed during a copulatory phase	Ear pinning; head throws; high pitch vocalizations; looking to one side	None	None or sudden repositioning before another series of pelvic thrusts
Ejaculation	Normal when pain symptoms are under control	Low number of urethral pulsations, but only seminal plasma present; poor pressure of ejaculatory jets	No urethral pulsations, and no fluid expelled; normal, once ejaculatory threshold reached
Long-term effects	Normal sexual behavior if pain symptoms are under control; low libido, if pain symptoms are present	Normal sexual behavior once a blockage is resolved	Continuous or frequently re-occurring ejaculatory difficulties

morphological defects or immature germ cells in ejaculates. Usually, there is a high number of spermatozoa with secondary morphological defects, such as bent tails, distal cytoplasmic droplets, and tailless heads. Occasionally, all semen parameters are consistently good. Just one subtle change occurs unexpectedly; for example, longevity of sperm motility in extended and cooled semen decreases dramatically.

The typical picture of semen collected from stallions with temporarily plugged ampullae is rarely seen in cases discussed in this article. After ampullar occlusion is relieved, normal, forceful ejaculation occurs and large numbers of spermatozoa, stored in dilated ampullae, are expelled. Concentration of semen is very high and there is a very high percentage of tailless heads of spermatozoa in such an ejaculate [11]. Ejaculatory dysfunction associated with the midline cyst of the colliculus seminalis is a chronic condition, and there is no major improvement after obtaining a complete ejaculate. Occasionally, stallions with this condition experience transient hemospermia, chronic oligospermia, asthenozoospermia, or necrospermia. Interestingly, some stallions expel semen containing a collection of small aggregations of sperm and bacteria. Other stallions with chronic ejaculatory difficulties and midline cyst of the colliculus seminalis have hyperechoic plugs in the very terminal portions of deferent ducts (distal to ampullae). These plugs may be expelled during ejaculation and contain very high numbers of spermatozoa and bacteria as well. *Corynebacterium* species was identified in the semen of three stallions with these features. We have not seen any inflammatory cells in the expelled plugs or semen produced by these stallions.

3.3. Evaluation of Internal Genitalia

Rectal palpation and TRUS of internal reproductive structures in stallions with ejaculatory dysfunction are

essential, and should be conducted carefully. All accessory glands, urethra, and the caudal aorta are examined. Location, size, texture, and sensitivity of both ampullae are assessed first, during rectal palpation. The lumen of the ampullae of deferent ducts may be normal, but it may be significantly dilated, especially after unsuccessful attempts to collect semen (Fig. 3). Hyperechoic concretions are frequently found in the ampullar lumen, especially in the narrow part of deferent ducts, distal to the prostatic lobes. These concretions are single or numerous, and have a tendency to move distal and group together after multiple attempts of a stallion to ejaculate (Fig. 4). Vesicular glands may become distended as well, if the ejaculatory process is affected (Fig. 5). If the excretory ducts of the vesicular glands are compressed for a prolonged period, their contents may become very thick and form echogenic plugs (Fig. 6).

Cystic structures are found in various locations. Small cysts of the uterus masculinus are found in up to 50% of normal stallions, most often at the level of the neck of the urinary bladder, between ampullae, which are narrowing down in this area toward the colliculus seminalis [12]. The presence of these structures usually has no consequences in the stallion's ejaculatory function. However, we reported an increased frequency of this feature in the population of stallions with ejaculatory problems [4]. Our recent clinical material suggests that larger cystic structures, exceeding 1 cm in diameter, and localized more caudally, at the level of the seminal colliculus, contribute to the stallion's ejaculatory difficulties more often. The presence of these cysts is often overlooked because they are localized very distally, in the pelvic urethra, just cranial to the bulbourethral glands, but distal to the prostatic isthmus. They usually have an oval shape, but may be also tear-shaped, rectangular, or spindle-shaped (Fig. 7). An average diameter of these cysts, found in our clinical cases, varied from 1 to 3 cm (Table 1). They may be well-defined with hyperechoic walls, or may be quite difficult to delineate. They may also have

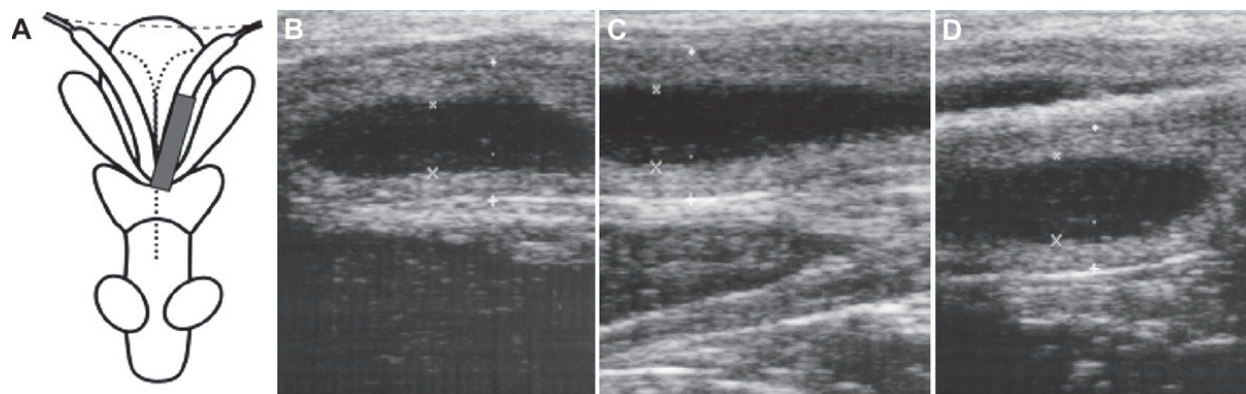


Fig. 3. Ultrasound images of dilated ampullae of deferent ducts in a stallion with the midline cyst of the colliculus seminalis: (A) Position of a transducer, (B) Ultrasound image obtained immediately after the first attempt to collect semen, (C) Ultrasound image obtained immediately after the second attempt to collect semen (same day as the previous attempt), (D) Ultrasound image obtained immediately after the third attempt to collect semen (same day as the previous attempt); dilated excretory duct of the vesicular gland visualized on the dorsal aspect of the ampulla.

echogenic contents (Fig. 7F). A small collection of non-echoic fluid is often seen in the urethral lumen posterior to the cyst after an unsuccessful attempt to collect semen (Fig. 7B). Other findings of the ultrasound evaluation of the internal reproductive tract of the affected stallion are usually unremarkable.

Urethroscopic evaluation of stallions with ejaculatory dysfunction is rarely conducted and the findings of this evaluation rarely add to the diagnosis. Slight enlargement of the colliculus seminalis is occasionally seen in affected cases.

3.4. Evaluation of the Scrotum

All structures of the scrotum are carefully examined by using manual palpation and ultrasonography. Testes are normal in size and texture, but could be smaller than expected for the adult stallions, and/or have a tendency to have soft consistency. Ultrasound evaluation of testicular parenchyma is unremarkable. However, some subtle changes may be seen within/or in the vicinity of the epididymides in these stallions. Thin-walled cysts, irrespective of whether they are small or large, are often visualized in the area of the epididymal heads. They may be single or multiple, and have anechoic contents. In some cases, however, there are hyperechoic areas or concretions in the epididymal heads or tails. The distal part of

the epididymal duct may be prominent with a slightly distended lumen. A mild hydrocele is often seen.

4. Treatment and Management

Currently, there is no effective treatment for this condition. However, the affected stallions can be managed successfully, if their problem is recognized early enough to properly adjust their mare book, and come up with a set of specific procedures, which will enhance a probability of a success. Because there is no guarantee that semen will be successfully collected on any given day, the owners of mares, booked to the affected stallions, should be informed ahead of time of the problem. To enhance the chances for success, a team working with the stallion should be prepared for the necessity of numerous attempts to collect semen. There should be a plan about how to proceed in the case of an initial failure. There is no certain protocol equally effective in all cases; a specific protocol should be established for each affected individual stallion.

Transrectal massage of the ampullae of the deferent ducts is rarely effective in stallions with midline cysts of colliculus seminalis. Although inspissated sperm, which occludes the ampullae, can be manually advanced during transrectal massage, the cysts are continuously impinging on the ejaculatory apparatus and cannot change their location. Strong teasing and the administration of oxytocin

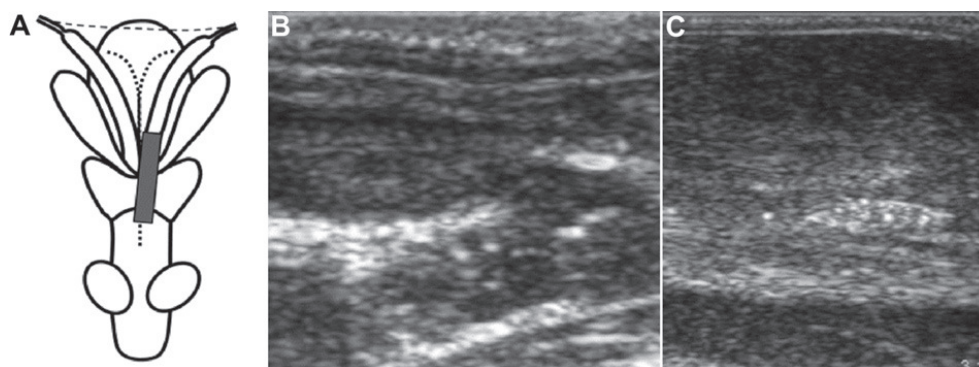


Fig. 4. Ultrasound images of hyperechoic concretions in deferent ducts in stallions with the midline cyst of colliculus seminalis: (A) Position of a transducer, (B) Ultrasound image of one, solid concretion (plug) in a narrow part of the terminal part of the deferent duct, (C) Ultrasound image of the multiple hyperechoic concretions in the terminal part of the deferent duct.

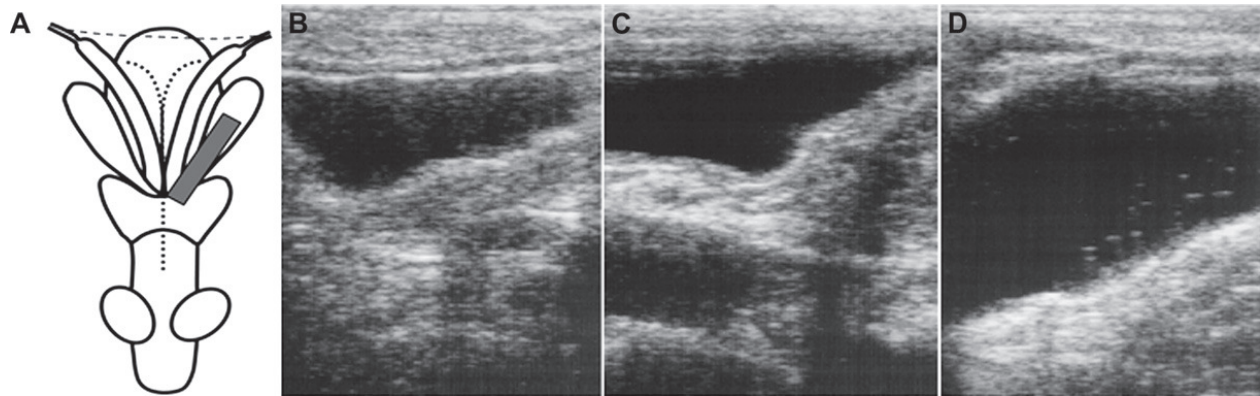


Fig. 5. Ultrasound images of dilated vesicular glands in a stallion with the midline cyst of the colliculus seminalis: (A) Position of a transducer. (B) Ultrasound image obtained immediately after the first attempt to collect semen. (C) Ultrasound image obtained immediately after the second attempt to collect semen (same day as the previous attempt). (D) Ultrasound image obtained immediately after the third attempt to collect semen (same day as the previous attempt).

shortly before semen collection can be helpful in some individuals. A combination of pretreatment with imipramine (1,200 mg, per os, 2 hours before semen collection), heavy teasing, and treatment with oxytocin (10–30 IU, iv; immediately before semen collection) seems to be most effective. In addition, stallions with chronic ejaculatory dysfunction often develop painful sores on the medial side of their carpi, as well as chronic back or hind legs problems, because of the multiple mounts on a dummy or a mare. These complications may further contribute to problems with ejaculation. Wrapping front limbs (carpi) prevents development of sores, and therefore, it is recommended in all stallions with ejaculatory dysfunctions. The number of attempts to collect semen should be limited so as to prevent secondary musculoskeletal problems. Long-term treatment with phenylbutazone can help in managing potential discomfort during pelvic thrusting.

5. Clinical Examples

5.1. Case 1

A 7-year-old Thoroughbred stallion was evaluated as a potential candidate for teaching veterinary students (Table 1; case 1). The horse was in an excellent body condition and showed no abnormalities during a general physical examination. The stallion showed a good libido in

the presence of the ovariectomized teaser mare, readily achieved an erection in the breeding shed and mounted a dummy. Despite good coupling with a dummy, numerous pelvic thrusting after insertion of the penis into the Missouri AV (8 to 9 thrusts) did not yield an ejaculate. The attempts to collect semen from this stallion were repeated multiple times without a success. All sessions were video-recorded. This material was carefully reviewed and showed no evidence of discomfort or problems with the AV. The stallion showed some strong attempts to ejaculate expressed by one or two urethral contractions accompanied by tail flagging after a series of thrusting, with no ejaculation achieved. There were no early dismounts or signs of relaxation. Additional stimulation, such as hot compresses on the base of the penis, or the Colorado model AV (Animal Reproduction Systems, Chino, CA) was used to enhance the ejaculatory process. Regardless of the technique used, the stallion ejaculated only occasionally, always after multiple attempts. Semen quality, when collected, was fair to good. TRUS of this stallion's internal genitalia revealed the oval cystic structure (1.13 cm in diameter) in the pelvic urethra in the close proximity to the bulbourethral glands, behind the prostate (Fig. 8A). In addition, small hyperechoic concretions were detected in the most terminal part of each deferent duct. Transurethral endoscopic examination was performed and the colliculus seminalis was visualized. Simultaneously, TRUS was

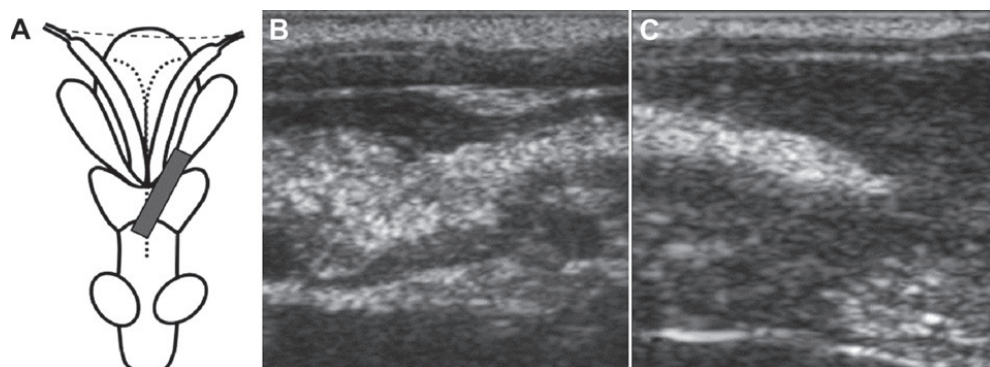


Fig. 6. Ultrasound images of the hyperechoic contents in the vesicular glands in a stallion with the midline cyst of colliculus seminalis: (A) Position of a transducer. (B) Ultrasound image of the hyperechoic contents in the mid portion of the vesicular glands. (C) Ultrasound image of the hyperechoic contents in the excretory duct of the vesicular gland.

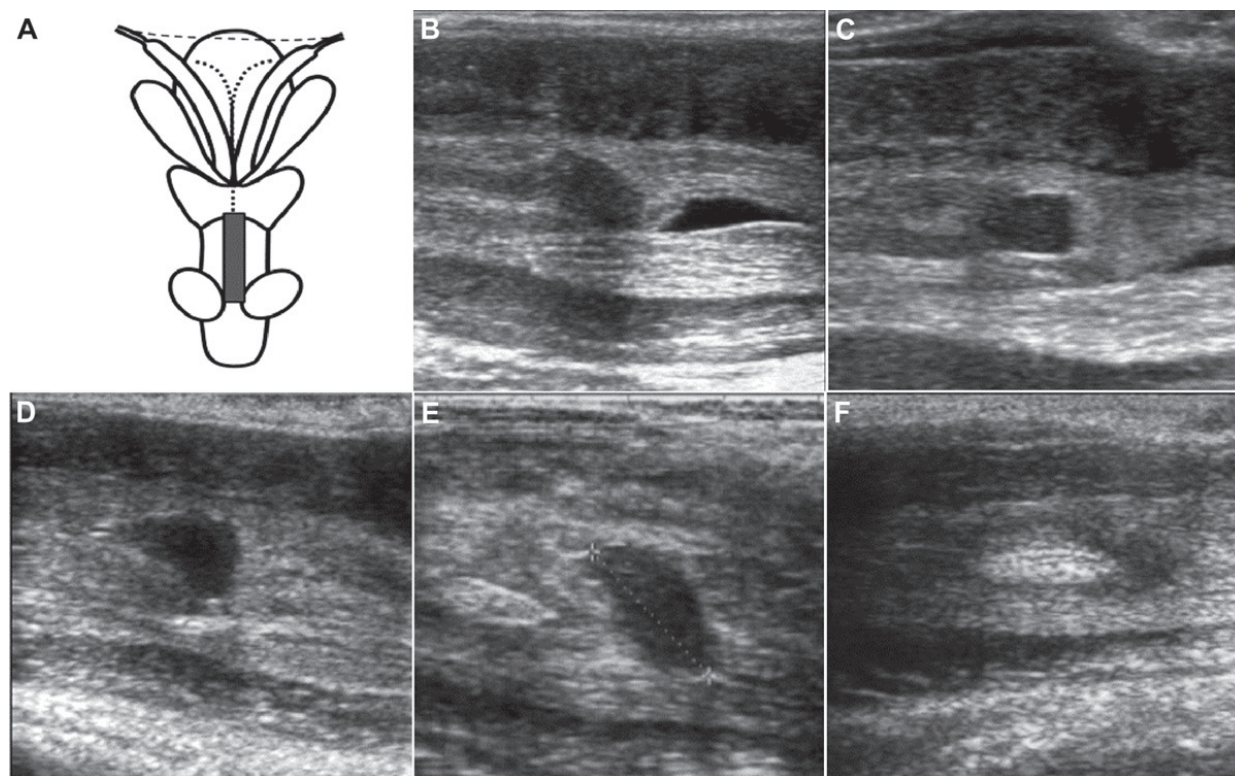


Fig. 7. Ultrasound images of the midline cysts of the seminal colliculus in stallions with ejaculatory problems: (A) Position of a transducer. (B) Oval-shaped cyst. (C) Rectangular cyst. (D) Tear-shaped cyst. (E) Spindle-shaped cyst and echogenic contents in the terminal seminal tract. (F) Echogenic contents inside the cyst.

performed. These two techniques performed together revealed that the cyst was localized exactly within the colliculus seminalis. There was also a polyp-like structure associated with the opening to the left ED. The stallion had to be euthanized because of the acute onset of equine protozoal myeloencephalitis. Postmortem evaluation of the genital tissues revealed the presence of the multiple cysts between the most terminal portions of deferent ducts, within the colliculus seminalis, which were significantly occluding their lumen (Fig. 8B). The cysts were filled with noncellular fluid and had stratified, squamous epithelium (Fig. 8 C, D). The location, lack of communication with the urethra, lack of spermatozoa in the cystic fluid, and the character of the epithelium suggested that this cyst was consistent with what is described in men as a midline cyst of prostate type I [13].

5.2. Case 2

An 8-year-old Quarterhorse stallion was presented to our clinic with a history of ejaculatory difficulties (Table 1; case 2). There were always problems with collecting semen from this stallion, but in the past few weeks all attempts to obtain semen failed. General physical examination of the stallion did not reveal any abnormalities, except some fresh abrasions on the medial aspects of his carpi, most likely because of the multiple mounts on the dummy. Ultrasound evaluation of his external and internal genitalia revealed prominent epididymal ducts and mildly dilated ampullae of deferent ducts. Terminal parts of both deferent ducts (distal to ampullae) contained multiple hyperechoic concretions (Fig. 9A). In addition, there was

a large (4×0.6 cm), spindle-shaped uterus masculinus lying just underneath the isthmus of the prostate, between the very distal parts of the ampullae (Fig. 9B). Furthermore, there was an oval-shaped midline cyst on the level of the colliculus seminalis (1×0.8 cm). Before the first attempt to collect semen, distal ampullae were massaged per rectum and 30 IU of oxytocin were administered intravenously. The stallion showed excellent libido, readily mounted a dummy, had multiple thrusts (9 thrusts), but did not ejaculate. During the second attempt, hot towels were applied to the base of the stallion's penis and a very small amount (5 mL) of semen with a "grid-like" appearance and poor motility of spermatozoa ($<10\%$) was obtained. Cytological evaluation revealed that the solid particles, which gave the semen a "grid-like" appearance, consisted of spermatozoa and large numbers of bacteria (Fig. 9C). No inflammatory cells were found. Subsequent attempts to collect semen yielded inconsistent results, despite various combinations of treatment with imipramine, oxytocin, rectal massage of the ampullae, and the application of hot compresses. The quality of semen was also inconsistent, but the motility was generally improving. Further distention of distal ampullae, as well as vesicular glands, was observed after unsuccessful attempts to collect semen. Some improvement in the ability to collect semen was observed after the stallion was given 2 weeks of rest for healing the carpal wounds, and treatment with phenylbutazone so as to decrease possible musculoskeletal discomfort associated with multiple mounts and pelvic thrusts (9 to 16 thrusts). Currently, the stallion continues to experience ejaculatory dysfunction. However, strong teasing, treatment with imipramine and oxytocin, as well

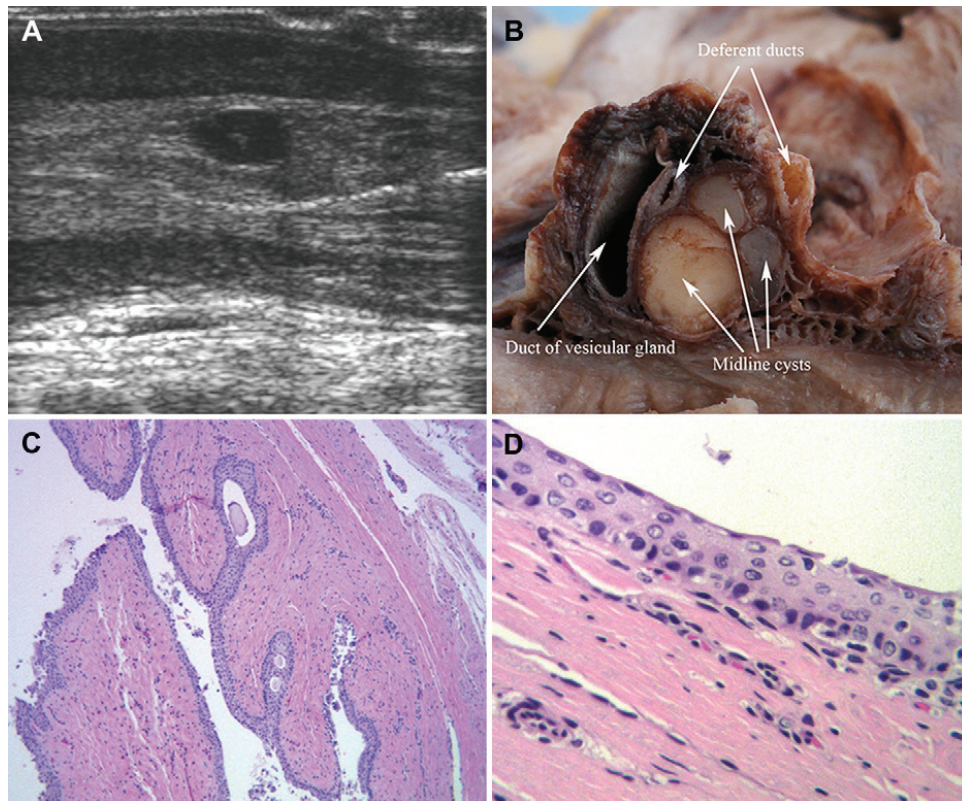


Fig. 8. Case 1. (A) Ultrasound image of the midline cyst of the colliculus seminalis. (B) Cross-section of the urethra at the level of the colliculus seminalis with the cyst. (C) Microscopic slide with a wall of the midline cyst—low power. (D) Microscopic slide with a wall of the midline cyst—high power.

as additional stimulation of the base of the penis are helpful in obtaining semen samples.

6. Discussion

EDs in men are long and narrow, which make them prone to obstruction [14]. One to five percent of infertility cases in men are associated with ED occlusion (EDO) [15]. One of the early symptoms of this condition is painful ejaculation and azoospermia [16]. However, the symptoms may be much more subtle in cases of a partial obstruction and show only as mild oligospermia, oligoasthenospermia, or poor survival of spermatozoa in vitro and inability to fertilize oocytes [16,17]. In contrast to men, EDs in stallions

are short (approx. 2 to 3 mm) and relatively wide (6 to 7 mm) [7]. Therefore, true EDO rarely occurs in stallions. Cystic structures, which are often seen between ampullae of the deferent ducts in stallions, usually do not have any clinical significance. Small midline cysts of the colliculus seminalis in stallions may be also asymptomatic. We have found such cysts in six animals during the screening ultrasound evaluation of the population of 100 fertile stallions [4]. One of these stallions required strong stimulation during semen collection, one stallion had hemo-spermia, and other three had poor quality of semen. Large cysts in the area of the colliculus seminalis can affect the passage of semen through the very terminal part of the deferent ducts to cause ejaculatory problems [6]. The cystic

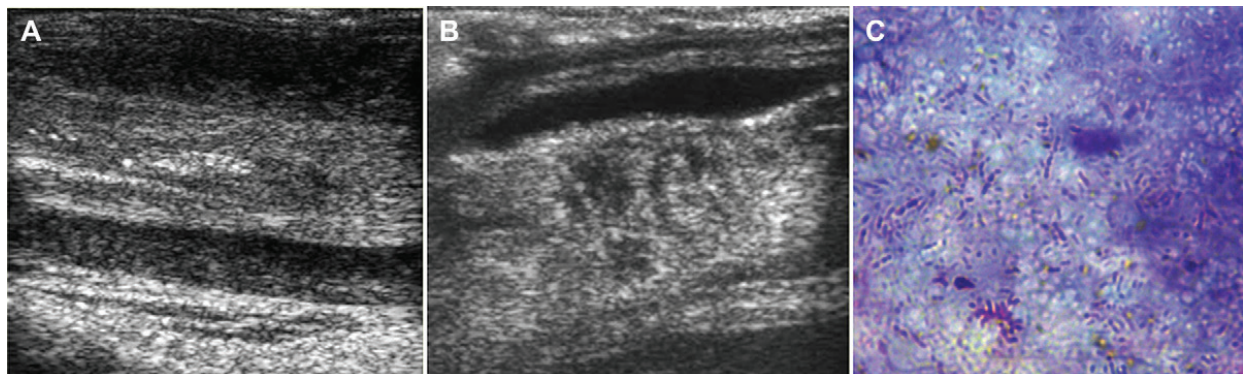


Fig. 9. Case 2. (A) Midline cyst of colliculus seminalis and hyperechoic particles in the terminal seminal tract. (B) Cystic uterus masculinus—longitudinal section. (C) Microscopic image of the expelled “grid-like” particles.

structure found in the stallion with ejaculatory dysfunction in case 1 was obviously compressing the terminal portions of both deferent ducts, excretory ducts of vesicular glands, as well as EDs. Extensive anatomical and histological studies showed that this structure in stallions is of mixed embryological origin. The proximal portion is a remnant of the Müllerian ducts, whereas the most distal part comes from the urogenital sinus [18]. Because the cyst in case 1 had stratified, squamous epithelium, its origin was most likely associated with the latter. Because there was no sperm in the lumen of this cyst, there was no communication between the cyst and the urethra, deferent ducts, or EDs. These types of cysts have been described in men as the midline cysts of the prostate, type 1 [13]. Other cysts of this area in men can communicate with the urethra (type 2a), or the seminal tract (type 2b). Third, there may be cystic dilatations of the ED (type 3). Similar variations of this structure in stallions have been described. However, an appropriate terminology has not been established yet [12]. We propose to use the existing medical terminology for different types of cysts (type 1, 2a, 2b, and 3), but we also propose to replace the term “midline cysts of the prostate” or “prostatic utricle” with another term,— “midline cysts of the colliculus seminalis,” because colliculus seminalis in stallions is located behind the caudal edge of the prostate.

Various protocols for the diagnosis and treatment of ejaculatory dysfunctions in men, associated with the ejaculatory apparatus, are currently available. Vasography, TRUS, magnetic resonance imaging, and other imaging modalities are used [19–21]. Most often, the presence of the so-called midline prostatic cyst is identified as a major source of these problems. However, seminal vesicle calculi, postsurgical or postinflammatory scar tissue, or calcification near the colliculus seminalis can also be a source of obstruction. If no physical abnormality is found, dynamic tests are recommended to diagnose a possible functional disorder of ejaculation in men [21–23]. For seminal vesiculography, nonionic contrast (50% renografin) is injected transectally into the seminal vesicle using TRUS guidance [15]. The bladder neck is occluded using a balloon of a small Foley catheter introduced through the pelvic urethra. Fluoroscopy is performed soon after injection to obtain the image of retrograde vasogram. Lack of flow of contrast medium in the pelvic urethra confirms EDO. The newest TRUS-guided diagnostic method, chromotubation, has been introduced to allow for the very accurate assessment of the potency of the EDs. Diluted indigo carmine or methylene blue (1:5 dilution in saline) is injected to the seminal vesicles, and the emission of this dye from the ejaculatory orifices is observed directly using cystoscopy [15]. Recently, chromotubation technique has been modified such that injection pressure can be directly measured during the procedure. It has been established that fertile patients have remarkably consistent ED opening pressure (<45 cm H₂O), whereas the patients with EDO have significantly higher ED opening pressure than normal patients [22]. Transurethral resection of the ED is a treatment of choice for EDO in men [24,25]. This is an outpatient procedure, which in most cases requires only regional anesthesia. The colliculus seminalis is resected under direct visualization, using a cystoscope and an electrocautery loop to clear the obstructed ejaculatory path. If the correction is

successful, cloudy or milky fluid should appear refluxing from the opened ducts. Even though this procedure is quite successful in selected patients, there are some potential complications associated with it, such as watery ejaculate, hematuria, epididymitis, seminal vesiculitis, and very rarely incontinence or rectal perforation [15]. Recently, limited success was also reported using less invasive techniques, such as TRUS-guided ethanol sclerotherapy of the cysts, or endoscopic dilation of the EDs [26,27].

Currently, there is no effective and permanent treatment for similar disorders in stallions. However, cannulation of the EDs in stallions can be performed using a long, flexible endoscope. Trained theriogenologists use this technique to aspirate contents of the vesicular glands as well as to administer antibiotics in cases of seminal vesiculitis. Therefore, aspirating the midline cyst of the colliculus seminalis, administering ethanol to its lumen (sclerotherapy), or even opening the cyst using an electrocautery loop should be possible in the affected cases. The effectiveness of transurethral surgical procedures correcting physical obstructions of the EDs in stallions should be explored. There is also a need to introduce dynamic imaging techniques, which would allow more detailed evaluation of the ejaculatory apparatus in stallions.

References

- [1] McDonnell SM. Reproductive behavior of the stallion. *Vet Clin North Am Equine Pract* 1986;2:535–55.
- [2] Martin BB, McDonnell SM, Love CC. Effects of musculoskeletal and neurologic disease on breeding performance in stallions. *Compend Contin Educ Pract Vet* 1998;20:1159–69.
- [3] Ball B. Diagnostic methods for evaluation of stallion subfertility: a review. *J Equine Vet Sci* 2008;28:650–65.
- [4] Pozor M. Diagnostic applications of ultrasonography to stallion's reproductive tract. *Theriogenology* 2005;64:505–9.
- [5] Little TV, Woods GL. Ultrasonography of accessory sex glands in the stallion. *J Reprod Fert* 1987;(Suppl 35):87–94.
- [6] Little TV. Accessory sex gland and internal reproductive tract evaluation. In: Rantanen NW, McKinnon AO, editors. *Equine diagnostic ultrasonography*. Baltimore, MD: Williams & Wilkins; 1998. p. 271–88.
- [7] Sisson S. A textbook of veterinary anatomy. Philadelphia, PA: W.B Saunders Company; 1910.
- [8] Kenney RM, Hurtgen J, Witherspoon D, Simons J. Society for Theriogenology manual for clinical evaluation of the stallion. In: *Journal of the Society for Theriogenology* 1983; IX. p. 9–10.
- [9] Pozor M, Tischner M. The stability of copulatory behavior in stallions. In: *Proceedings of 12th International Congress on Animal Reproduction*. Hague; 1992:1912–1914.
- [10] McDonnell SM, Hinze AL. Aversive conditioning of periodic spontaneous erection adversely affects sexual behavior and semen in stallions. *Anim Reprod Sci* 2005;89:77–92.
- [11] Love CC, Riera FL, Oristaglio RM, Kenney RM. Sperm occluded (plugged) ampullae in the stallion. In: *Proceeding Society for Theriogenology* 1992:117–125.
- [12] Swoboda A. Beitrag zur Kenntnis des Utriculus masculinus der Haustiere. *Zeit Ges Anat* 1929;89:494–512.
- [13] Furuya R, Furuya S, Kato H, Saitoh N, Takahashi S, Tsukamoto T. New classification of midline cysts of the prostate in adults via a transrectal ultrasonography-guided opacification and dye-injection study. *BJU Int* 2008;102:475–8.
- [14] Nguyen HT, Etzell J, Turek PJ. Normal human ejaculatory duct anatomy: a study of cadaveric and surgical specimens. *J Urol* 1996;155:1639–42.
- [15] Smith JF, Walsh TJ, Turek PJ. Ejaculatory duct obstruction. *Urol Clin North Am* 2008;35:221–7.
- [16] Fisch H, Lambert SM, Goluboff ET. Management of ejaculatory duct obstruction: etiology, diagnosis, and treatment. *World J Urol* 2006;24:604–10.
- [17] Beiswanger JC, Deaton JL, Jarow JP. Partial ejaculatory duct obstruction causing early demise of sperm. *Urology* 1998;51:125–7.

- [18] Guyon L. Recherches sur litricule prostatique chez le cheval entier ou castré. *C R Soc Biol* 1939;131:1167–9.
- [19] Engin G, Celtik M, Sanli O, Aytac O, Muradov Z, Kadioglu A. Comparison of transrectal ultrasonography and transrectal ultrasonography-guided seminal vesicle aspiration in the diagnosis of the ejaculatory duct obstruction. *Fertil Steril* 2009;92:964–70.
- [20] Engin G, Kadioğlu A, Orhan I, Akdöl S, Rozanes I. Transrectal US and endorectal MR imaging in partial and complete obstruction of the seminal duct system. A comparative study. *Acta Radiol* 2000;41:288–95.
- [21] Purohit RS, Wu DS, Shinohara K, Turek PJ. A prospective comparison of 3 diagnostic methods to evaluate ejaculatory duct obstruction. *J Urol* 2004;171:232–5.
- [22] Eisenberg ML, Walsh TJ, Garcia MM, Shinohara K, Turek PJ. Ejaculatory duct manometry in normal men and in patients with ejaculatory duct obstruction. *J Urol* 2008;180:255–60.
- [23] Orhan I, Duksal I, Onur R, Balci TA, Poyraz K, Firdolas F, et al. Technetium Tc 99m sulphur colloid seminal vesicle scintigraphy: a novel approach for the diagnosis of the ejaculatory duct obstruction. *Urology* 2008;71:672–6.
- [24] Cornel EB, Dohle GR, Meuleman EJ. Transurethral deroofing of midline prostatic cyst for subfertile men. *Hum Reprod* 1999;14:2297–300.
- [25] Kadioglu A, Cayan S, Tefekli A, Orhan I, Engin G, Turek PJ. Does response to treatment of ejaculatory duct obstruction in infertile men vary with pathology? *Fertil Steril* 2001;76:138–42.
- [26] Wang Y, Liu X, Lin Q. Transrectal ultrasound-guided ethanol sclerotherapy for Müllerian duct cyst. *Zhonghua Nan Ke Xue* 2006;12:712–3.
- [27] Xu B, Niu X, Wang Z, Li P, Qin C, Li J, et al. Novel methods for the diagnosis and treatment of ejaculatory duct obstruction. *BJU Int* 2008;102:263–6.