Problems of the accessory sex glands
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Abstract
Problems of the accessory sex glands are reported in stallions. Seminal vesiculitis, although uncommon, is nonetheless the most frequently reported inflammatory/infectious pathology of the upper reproductive tract in stallions. Sperm occlusion of and accumulation within the ampullae is a common problem in breeding stallions, particularly following periods of sexual rest. It is important for theriogenologists to recognize these problems of the ampullae as they are typically highly treatable. In this presentation, the diagnosis and treatment of seminal vesiculitis will be reviewed. Sperm occlusion of and sperm accumulation within the ampullae also will be reviewed and data from a new case series will be presented. Finally, a case series of prostatic masses in geldings will be introduced.

Keywords: Stallion, accessory glands, seminal vesicles, ampullae, prostate

Introduction
The normal stallion possesses a full complement of accessory sex glands, including paired ampullae, paired seminal vesicles, a single, bilobed prostate, and paired bulbourethral glands. These glands function in adding fluid volume, enzymes, amino acids and buffers to the ejaculate. The paired ampullae are the most cranial glands and are thickenings of the ducti deferentia proximal to the entry of the ducts into the urethra. Just caudal and lateral to the ampullae are the paired seminal vesicles. The seminal vesicles extend laterally from the midline at an approximate 40-degree angle to the urethra. When empty, the seminal vesicles become flattened and when distended with fluid they become roughly oval. The seminal vesicles empty into the urethra with the ampullae at the seminal colliculus. The isthmus of the prostate is located on the ventral midline caudal to the seminal vesicles and dorsal to the trigone region of the bladder. The right and left lobes of the prostate extend laterally from the isthmus. The prostate gland empties into the urethra through numerous prostatic ducts. The paired bulbourethral glands are roughly spherical and are located on either side of the urethra just cranial to the anal sphincter at the ischial arch.

Seminal vesiculitis is reported infrequently, but can have a significant impact on reproductive function. Additionally, although ampullary blockage and sperm accumulation in the ampullae are frequently discussed in the clinical setting and have been reviewed in several texts, only one case series describing blockage of the ampullae has been reported. Prostatic disease and clinically significant problems of the bulbourethral glands have not been reported in the horse to our knowledge. This presentation will describe the clinical features of seminal vesiculitis, and will provide additional detailed descriptions of the features of sperm accumulation and ampullary blockage in a new case series of stallions. Additionally, the clinical signs and progression of recently observed prostatic masses in geldings will be introduced.

Seminal vesiculitis
Although uncommon, seminal vesiculitis is the most frequently reported inflammatory/infectious pathology of the upper reproductive tract in stallions. Affected animals typically are presented for gross abnormalities of the ejaculate (hemospermia, pyospermia, discolored semen, and/or clumps of debris in the ejaculate) poor semen quality (most often due to reduced longevity of sperm motility) and/or subfertility. In one instance, signs of colic were attributed to seminal vesiculitis and we have similarly observed a stallion with pain-related self-mutilation that appeared at least in part to be associated with severe seminal vesiculitis. Affected stallions also may experience pain during ejaculation and thus may be presented for ejaculation failure. Microscopic examination of ejaculated semen may reveal all or any of the following: numerous neutrophils, bacteria (sometimes intracellular), red blood cells, and reduced sperm motility or reduced longevity of sperm motility. These findings should prompt further
examination of the stallion's genitalia to determine the source of the problem. Palpation per rectum of affected glands may reveal no abnormalities. However, in some acute cases, the affected gland is enlarged, painful, and filled with fluid.

The ultrasonographic appearance of affected seminal vesicles may aid in the diagnosis of seminal vesiculitis, although it is not always diagnostic. Ultrasoundographically, fluid within the affected gland(s) can vary from anechoic to relatively echogenic and often will contain particulate debris or fibrin tags. The lumen of the gland may be irregular. Familiarity with the appearance of normal seminal vesicles is very helpful since normal glands in sexually stimulated stallions also can become dramatically enlarged and filled with anechoic fluid. In cases of chronic seminal vesiculitis, affected glands become firm to hard and may contain little or no fluid.

Beta-hemolytic streptococcus, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Staphylococcus* spp., *Brucella abortus*, *Acinetobacter calcoaceticus* and *Streptococcus equisimilis* have been reported as causative agents of seminal vesiculitis in stallions. The causative organism often can be isolated through bacteriologic culture of ejaculated semen, although additional cultures, including cultures of the penile urethra before and after ejaculation and of the external surface of the penis also typically are indicated. Fractionation of the ejaculate and culture and cytologic examination of each fraction may aid in diagnosis since the contents of the seminal vesicles should be expelled predominantly or exclusively in the final fractions. Culture results must be interpreted judiciously since it is not uncommon to isolate contaminant bacteria originating from the penis or even the artificial vagina. A pure, heavy growth of an organism together with neutrophils in the ejaculate is likely to be significant.

Appropriate systemic antimicrobial therapy based on sensitivity results can then be instituted. However, systemic antimicrobials alone may not be curative, even if a prolonged and often expensive course of therapy is undertaken. Alternatively, or in addition to systemic antimicrobials, a 1 m pediatric flexible endoscope can be passed through the urethra, and a catheter or culture swab can then be advanced directly into the affected gland via the seminal colliculus to aspirate and/or culture its contents. In some cases, the endoscope itself can be advanced through the seminal colliculus directly into each seminal vesicle. This permits visualization of the lumen of the vesicles and their contents. This approach can also aid in treatment. A small plastic catheter can be advanced into the gland through the biopsy channel of the endoscope and the gland can be lavaged with sterile saline and then infused with appropriate antimicrobials. We treat affected stallions once daily using this technique and treatment is continued as indicated (generally one to two weeks). In the author’s experience repeated cannulation of the seminal colliculus, as is often done for daily treatment, can lead to inflammation of the entrance to the glands and make future attempts at cannulation more and more challenging. Irritating antimicrobial infusions can potentiate inflammation. Progressive inflammation can obscure the opening of each colliculus and also can mechanically reduce the size of the openings.

It is our observation that one or more semen collections prior to intravesicular lavage and infusion help to evacuate the glands prior to antimicrobial infusion, and so may facilitate successful therapy. Systemic nonsteroidal anti-inflammatory drugs also can be included in the treatment plan. Evaluation of semen quality and regular ultrasonographic evaluations of affected glands can be used to monitor response to treatment.

One report of seminal vesiculectomy in a stallion has been published. Surgery was performed via a perineal incision and the affected seminal vesicle was removed with an emasculator in a manner similar to the technique used in bulls. In this case, surgery was curative. Alternative surgical techniques have also been reported. Note that seminal vesiculectomy may result in a decrease in the percentage of morphologically normal sperm.

In our experience, the prognosis for stallions with seminal vesiculitis is fair. Some cases reportedly resolve spontaneously while others remain refractory despite extensive therapy. Anecdotally, we have had good results in stallions treated with intravesicular antimicrobials combined with nonsteroidal anti-inflammatory drugs, although the cost of treatment is high and in some cases the problem recurs.
Prostatic masses

Over the past four years, we have examined four geldings that were presented for dysurea associated with prostatic masses. Masses were identified on palpation and ultrasonographic examination per rectum. In case one, portions of the mass extended into the urethra via the prostatic ducts. Surgical debulking of the mass was performed endoscopically through the urethra and resulted in a temporary improvement of clinical signs. Signs recurred within several months in association with regrowth of the mass and the horse was euthanized. Prostatic cystadenoma was confirmed postmortem. In case two, palliative treatment was unsuccessful and the horse was euthanized within nine months of diagnosis. Postmortem examination confirmed the presence of a leiomyosarcoma involving the prostate. Case three was euthanized within one year of diagnosis after unsuccessful palliative treatment, but was not available for postmortem examination. In the fourth case, a concurrent urolith was identified and removed surgically. Clinical signs abated and this animal is doing well approximately nine months postoperatively in spite of persistence of the prostatic mass.

Prostatic masses should be considered as differentials in male horses presented for dysuria. The prognosis for affected animals appears guarded. However, in some cases prostatic masses may be incidental findings and it is possible that these masses occur more frequently than is apparent but remain undiagnosed in the absence of clinical signs. Treatment options for prostatic masses in horses are limited because of the difficulty of obtaining prostatic tissue via biopsy and the surgical inaccessibility of the gland.

Sperm occlusion of and sperm accumulation within the ampullae

Sperm occlusion of the ampullae was first described in a group of six stallions in 1992.4 The condition is believed to result from sperm accumulating within the crypts and lumenae of the ampullae as the glands narrow prior to entry into the seminal colliculus. Over time, if the stallion is at sexual rest, these accumulations can continue to grow and eventually occlude the gland. Since the lumenae of the ampullae are continuations of the ducti deferentia, occlusion blocks passage of sperm from the testicles and epididymides and results in the clinical presentation of subfertility or infertility associated with oligospermia or azoospermia. It has been suggested that stallions with large testicles may be predisposed to this condition due to the associated higher sperm production.16 Stallions with bilaterally occluded ampullae present for infertility associated with azoospermia. Alkaline phosphatase levels in these ejaculates are low since the ejaculate contains no contributions from the testes or epididymides.21,22 In contrast, stallions with testicular origin azoospermia will have higher levels of alkaline phosphatase in the ejaculate, thus aiding in differentiating between the two conditions.

If the blockage becomes completely or partially dislodged, variable numbers of sperm will appear in the ejaculate. These sperm typically are damaged due to prolonged exposure to body temperature. Thus, asthenozoospermia and teratospermia are common, classically in association with a high percentage of tailless heads. In all of the six cases previously reported, palpable and ultrasonographic abnormalities of one or both ampullae were reported including ampullary enlargement, changes in ampullary tone, and changes in echogenicity.4

Treatment was based largely on a combination of ampullary massage per rectum and frequent semen collections with the goal of breaking up and clearing accumulated sperm. Oxytocin (20 IU iv immediately prior to semen collection) is often used to promote smooth muscle contractions. We have used substantially higher doses (up to 60 IU) with no obvious untoward effects. In protracted cases, 25–125 μg of cloprostenol can be administered intramuscularly approximately five minutes prior to semen collection.16 It has been suggested that intractable cases may benefit from antegrade catheterization and flushing of the ductus deferens near the tail of the epididymis.16,23

During treatment, as the occlusion is breaking up, sperm numbers tend to be highly variable and, during or following dissolution of the occlusion, sperm numbers often increased beyond what would be expected for testicular size. Stallions with only one functional testis appeared to be at increased risk, probably because these animals would be rendered azoospermic by even a unilateral ampullary blockage, assuming that the blockage was ipsilateral to the functional testis.4
We have examined information from a second group of stallions diagnosed with sperm occlusion of the ampullae and, in concurrence with the findings of Love et al\(^4\) have found no age or apparent breed predisposition (age range 3–30 years; numerous breeds represented). A disproportionate number of stallions were presented between February and March following prolonged sexual rest experienced during the nonbreeding season. Most stallions had ultrasonographic abnormalities of the ampullae, including hyperchoic material in the ampullary luminae, distended ampullary luminae, and/or heterogeneous glandular parenchyma. However, a minority of stallions had no obvious abnormalities on ultrasound. Thus, ultrasonography alone should not be used to rule in or rule out this condition.

Over half of the affected stallions had one abnormal or missing testis (hemicastration, unilateral cryptorchid, testicular tumor, unilateral degeneration), confirming that these animals are at increased risk and suggesting that unilateral blockages of the ampullae may be under-diagnosed in stallions with two normal testes. In stallions with unilateral blockages in which the contralateral testis is cryptorchid or diseased, alkaline phosphatase in the ejaculate remained elevated, thus complicating the diagnosis.

Treatment in all cases was built around frequent semen collections or frequent natural breedings. Oxytocin and/or prostaglandin and ampullary massage were administered to most, but not all stallions and the blockage resolved regardless. Time to resolution varied from one to ten days.

A potentially related condition, often called sperm accumulation syndrome, also is reported as a cause of subfertility in stallions. This condition has not been well-described in the reviewed literature, but has been discussed clinically and reported in texts as a variation on sperm occlusion.\(^{16,24}\) In this syndrome, it is hypothesized that sperm accumulate within the ampullae in association with sexual rest. However, the accumulation does not fully block the lumen of the gland. Thus, sperm continue to appear in the ejaculate, although sperm numbers may be highly variable. Like sperm occlusion, most sperm that reach the ejaculate are damaged probably due to prolonged exposure to body temperature within the ampullae. Thus, stallions affected with sperm accumulation also present with poor semen quality for testicular size and character, particularly when the stallion is at sexual rest or is breeding on only a very limited basis. The poor semen quality is typically due to both poor sperm motility and poor sperm morphology often, but not always, in association with a high percentage of tailless heads.

A necessary component of the stallion’s clinical picture is that semen quality improves to a variable degree when the stallion ejaculates frequently, presumably because accumulated sperm are being flushed out over time, thus allowing for a higher percentage of ‘fresh’ sperm from the testes and epididymides to reach the ejaculate. This ‘definition’ of sperm accumulation has not been standardized and, probably as a result, methods of diagnosing and treating the condition vary considerably. Depending on how rigid one sets the standards for diagnosis (e.g. it could be argued that any stallion showing improvements in semen quality with frequent collections could be affected by sperm accumulation syndrome), the incidence of the condition has been suggested to be as high as 30–40% following extended periods of sexual rest.\(^{16}\) In this presentation, the clinical findings in a series of stallions presenting for evaluation and treatment of sperm accumulation syndrome will be discussed. Specific case histories will be used to illustrate the characteristics of these problems.

**Acknowledgement**
The author thanks Dr. Marc Knobbe for assistance with prostatic mass case workups and data analysis.

**References**
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