

Diseases of the Reproductive Tract of the Male

Penis and Prepuce

1) Bull

a) Hematoma of the penis ("broken penis")

Etiology and pathogenesis

- mainly in beef bulls at the time of the breeding lunge. The penis is not properly inserted and may be bent ventrally, etc.
- although the peripenile vasculature or the dorsal artery of the penis may be ruptured, the tunica albuginea is most often ruptured, with hemorrhage resulting from the corpus cavernosum penis (ccp). The pressure in the ccp can be 200 - 400 lbs/sq inch at the time of breeding. The rupture most often occurs at the distal portion of the sigmoid flexure on the dorsum of the penis and is usually transverse to the long axis of the penis.

Diagnosis

- may have pain and stiffness of stride
- swelling just cranial to the scrotum which is initially soft, and later becomes firm as the hematoma clots and organizes. Sometimes the entire sheath may swell from edema and hemorrhage along the elastic tunic.
- the prepuce may prolapse, and in some cases there may be discoloration of the prepuce or sheath
- this condition must be differentiated from "waterbelly" (from urolithiasis and a ruptured urethra), cellulitis of the prepuce and/or sheath (swelling is usually farther down the sheath), etc.

Prognosis

- in general, smaller hematomas have a better prognosis for returning to breeding
- the penis can be protruded by tranquilizing the bull (0.01-0.05 mg/kg acepromazine I.V.) and/or massaging the accessory sex glands and the base of the penis by transrectal palpation. The penis can usually be grasped with a 4X4 gauze sponge and gently pulled out to see how far it extends. The farther the penis can be extended, the better the prognosis. If \leq 5-10 cm can be protruded, and little or none of the preputial fold can be seen, the prognosis is guarded to unfavorable. This technique is used by some to help determine the prognosis soon after the injury. After 60 days the electroejaculator can be used to help extend the penis (but the

methods described above are preferred) and evaluate the progress of the bull.

- if nerve damage results in permanent loss of sensation to the glans penis, the bull will probably not be able to find the vulva of the cow. Even if the bull does manage to penetrate the vagina, ejaculation may not occur.
- if the penis of the bull does not return to normal function by 6-8 months after the injury, collection by electroejaculation at an A.I. centre may be the only possibility for preserving the genetic potential of a valuable bull.

Treatment

(i) Conservative

- rest from sexual activity for 60-90 days or more
- systemic antibiotics for at least 7-10 days to prevent abscess formation in the hematoma. Consider using non-steroidal anti-inflammatories, especially in the early stages.
- hotpacks, hydrotherapy, and ultrasound therapy may reduce the resorption time of the hematoma, but are of questionable value. If hydrotherapy is used for acute cases, cold water can be sprayed on for 30-60 minutes BID to QID. For more chronic cases, warm water is used.
- treat preputial prolapses, if they exist (see subsequent notes).

(ii) Surgery

- it is best to remove the hematoma as soon as possible, and before organization of the clot and the formation of adhesions (which usually occurs 7-14 days after the injury). The optimal time for surgery may be 3 to 7 days after the injury occurs. This procedure is described in the Current Therapy in Theriogenology 2, Current Therapy in Large Animal Theriogenology, Large Animal Urogenital Surgery, Bovine and Equine Urogenital Surgery (by Walker and Vaughan), other surgery textbooks, and the surgery notes.
- surgery may reduce the recovery period as well as reduce the possibility of recurrence if the tunica albuginea is sutured (which should be done if it is possible without excessive trauma). However, surgery probably does not increase the number of affected bulls with small hematomas (≤ 10 -20 cm wide) that are returned to breeding.
- surgery may be most beneficial in bulls that have large hematomas (> 20 cm wide, and some authors say > 10 cm wide)
- bulls will probably require rest from sexual activity for more than 2 months after the surgery.

Complications

- abscess formation in the hematoma from hematogenous infection, needle aspiration, etc. These can be drained surgically but the prognosis is poor.
- adhesions from the hematoma or abscess that attach the penis to the surrounding tissues. These permanent fibrous adhesions prevent protrusion of the penis and will usually recur if they are surgically excised.
- nerve damage resulting in lack of sensation in the glans penis
- erection failure due to cavernosal venous shunts (see subsequent notes) or less commonly, due to scar tissue formation within the ccp
- recurrence of the hematoma in aggressive bulls
- pain at breeding.

b) Cavernosal venous shunts

Etiology and pathogenesis

- the corpus cavernosum penis (ccp) needs to be a closed system in order to produce erection of the penis.
- blood vessel connections between the ccp and the exterior circulation of the penis [or more rarely, between the ccp and corpus spongiosum penis (csp)] result in erection failure
- these shunts are either congenital in origin (which may increase in size as the bull ages) or result from damage to the tunica albuginea (which results from hematomas, lacerations, penis surgery, etc.). Shunts due to damage to the tunica albuginea are usually easier to correct than congenital shunts because they tend to be more localized.

Diagnosis

- unable to copulate and therefore must be differentiated from congenitally short penis, occlusion or thrombosis of the ccp, short retractor penis muscles, adhesions of the penis, etc.
- the penis may partially extend but is often relatively flaccid
- hypertrophy of the superficial blood vessels of the penis may be evident as well as blushing of the distal portion of the penis. Petechiation of the surface of the penis can sometimes be produced by occluding it with pressure applied by a hand.
- radiographic contrast material injected into the ccp can be used to see if it flows into blood vessels outside the ccp. These radiographs will also give one an idea of the location of the shunts. The details for this procedure are discussed in Large Animal Urogenital Surgery (most recent version of the technique), Current Therapy in Theriogenology 2, Bovine and Equine

Urogenital Surgery (by Walker and Vaughan), and The Compendium on Continuing Education for the Practicing Veterinarian 15:1160-1164, 1993. A modification of this procedure is described in Theriogenology 33:577-581, 1990.

Treatment

- surgical isolation and closure of the shunts. A solution of methylene blue injected into the ccp may assist in the location of the shunts. Shunts between the ccp and csp, or multiple congenital shunts, are usually not correctable. The details of the surgical procedures used are presented in the reference textbooks cited above as well as in large animal surgery textbooks.

c) **Hemospermia**

- caused by lacerations of the penis and prepuce, urethral damage due to calculi etc., urethral ulceration, urethritis, hemorrhage from the csp into the urethra, and hemorrhage from the surface of the glans penis
- treatment involves rest from sexual activity for at least 30 days, systemic antibiotic therapy when indicated, and treatment for urolithiasis when necessary (urolithiasis will be discussed in another course). The last two causes listed in the preceding point can be difficult to treat successfully. The treatment of lacerations to the penis and prepuce are discussed in subsequent notes.

d) **Urethral fistula**

- urethra opens proximal to its normal opening
- fertility may be reduced with natural mating because the semen is not deposited far enough forward in the vagina
- the etiology may be congenital in certain cases but can also be the result of trauma to the area e.g., hair rings (discussed later) that cause necrosis of the urethral wall
- the treatment involves surgical closure of the fistula, but dehiscence is common unless urine flow is temporarily diverted by ischial urethostomy.

e) **Deviations of the penis**

- the apical ligament of the penis originates on the dorsal midline of the penis, about 25 cm from the distal tip. Fibers from the ligament fan out over the distal portion of the penis. The fibers of the ligament have a firm attachment near the ventral portion of the left side of the penis but have a loose attachment on the right. The ligament prevents the penis from

deflecting ventrally and to the right. Deviations of the penis are often the result of abnormalities of this ligament.

- penile deviations occur mainly in the British beef breeds, especially polled breeds
- can be the result of trauma, but most often result from deficiencies of the apical ligament
- deviation of the penis often gradually develops over time, so that affected bulls may have one or more successful breeding seasons prior to infertility developing (i.e., the condition usually develops in bulls > 2.5-4 years old).

(i) Spiral deviation

- most common and tends to be moderately heritable
- the apical ligament slips off to the left side of the penis, giving it a left-handed corkscrew appearance
- this deviation occurs normally in many bulls during full erection inside the vagina. However, if the spiral occurs before the penis enters the vagina, copulation is impaired.

(ii) Ventral deviation

- thought to result from insufficiency or excessive length of the apical ligament, or from filling defects of the ccp, or altered architecture of the ccp or tunica albuginea

(iii) S-shaped curve of the penis

- least common
- the apical ligament of the penis is thought to be too short.

Diagnosis

- this is best done by observing the bull mount a cow. Repeated mounts are sometimes necessary to diagnose spiral deviation. The penis may spiral when the bull is collected with an electroejaculator but this is not diagnostic for spiral deviation of the penis. The diagnosis of ventral deviations can sometimes be made by using the electroejaculator.

Treatment

- bulls with a mild S-shaped deviation may be able to breed normally and no treatment is available for this condition
- treatments for spiral and ventral deviations of the penis consist of reinforcing the apical ligament and establishing a fibrous tissue connection between the ligament and the tunica albuginea. Repair of

ventral deviations are often unsuccessful unless the deviation is limited to the free portion of the penis. These procedures are described in Current Therapy in Theriogenology 2, Current Therapy in Large Animal Theriogenology, Large Animal Urogenital Surgery, and Bovine and Equine Urogenital Surgery. However, because spiral deviations of the penis may be inherited, treating this condition may be inadvisable.

f) Persistent frenulum

- may be inherited (recessive?)
- the epithelial surfaces of the penis and prepuce are fused at birth and are connected ventrally by a band of connective tissue called the frenulum. Epithelial separation and rupture of the frenulum occurs normally by puberty. If the frenulum persists it usually contains a blood vessel. A persistent frenulum will cause sharp ventral bending of the penis when erection occurs.
- treatment consists of incising the frenulum with or without previously ligating the blood vessel. It is recommended that treated bulls be used only on commercial herds because of the possible heritable nature of this condition.

g) Penile fibropapillomatosis (warts)

- caused by a papovavirus that is often spread from the warts on the bodies of other bulls through homosexual activity. It occurs most commonly on young bulls (12-18 months old) that are reared together and may eventually regress or detach but some persist.

Diagnosis

- the growths occur mainly on the free portion of the penis. They may become epithelialized, if chronic, and these may persist.
- the warts may become large enough that phimosis or paraphimosis (inability to extend or retract the penis, respectively) results
- hemorrhage from the prepuce may be observed.

Treatment and Control

- excision - for anesthetic use 5-10 ml of 2% lidocaine across the dorsum of the penis near the preputial orifice while the penis is held in extension, a ring block proximal to the lesion, or local anesthetic at the base of the fibropapilloma. It is advisable to catheterize the urethra so that it can be easily identified. Excise the wart at its base and ligate all blood vessels. It may be beneficial to suture the epithelium, especially if the wart was broad based. Alternatively, hemorrhage can be controlled with electrocautery or cryotherapy, but slow healing wounds may result. The bull should be rested from sexual activity for 3-4 weeks after the surgery.
- ligation - the base of the wart is ligated and allowed to slough off. The bull should be re-examined every 1-2 weeks in order to pull off the necrotic warts and tighten ligatures on those that are not necrotic.
- for the above procedures, an antibiotic ointment is applied to the penis and prepuce after the procedure is complete.
- autogenous and commercial wart vaccines can be used for prevention but are probably ineffective for therapy. The efficacy of autogenous vaccines may be superior to that of commercial vaccines.

h) Fibromas on the prepuce

- usually do not cause problems.

i) Inflammation of the penis and prepuce (balanoposthitis)

(i) Granular posthitis or granular venereal disease

- transient, disseminated, lymphoid hyperplasia on the surface of the penis and prepuce. This is a characteristic reaction of this area to

various infectious organisms and irritants but it generally should not result in infertility.

- rest from sexual activity for 2-4 weeks may be necessary in severe cases or to prevent possible venereal transmission of the disease. The local application of oily antibiotic preparations has also been used for therapy. The condition usually clears up on its own in 10-14 days.
- this condition is called granular vulvitis in the cow.

(ii) Infectious pustular balanoposthitis (IPB)

- caused by a herpesvirus very similar or identical to that which causes infectious bovine rhinotracheitis (IBR)
- slightly elevated nodules or vesicles form which can become pustules and then ulcers on the penis and prepuce that may become infected by bacteria and/or may coalesce. Pain may result in reluctance to breed.
- the diagnosis is usually based on the clinical signs, although virus isolation and other methods can be attempted
- rest from sexual activity for 3-8 weeks will be necessary to allow for healing and to prevent venereal transmission of the disease. The local application of oily antibiotic preparations may reduce the possibility of preputial adhesions or scarring.
- this condition is called infectious pustular vulvovaginitis (IPV) in the cow.

(iii) Balanoposthitis due to other causes

- occasionally bulls (especially at A.I. centres) may develop balanoposthitis from irritation or mild trauma to the prepuce. (Balanoposthitis from more severe trauma will be discussed elsewhere.) Probably, various opportunistic bacteria are involved in the inflammation.
- rest from sexual activity and the local application of oily antibiotic preparations are usually effective for treatment.

The **local application of antibiotic or antiseptic preparations to the preputial cavity** is usually performed with a 60 ml syringe inserted into the preputial orifice while the orifice is closed off around the syringe with one hand. After infusion of the antibiotic, the syringe is removed but the orifice is held closed while the antibiotic is massaged in. The syringe can also be attached to an infusion pipette for this procedure, but care must be taken not to traumatize the prepuce with the pipette.

A nonirritating antibiotic or antiseptic (not "Hibitane" = chlorhexidine gluconate) solution or a mixture of 1 part antibiotic and 1 part hydrogen peroxide are commonly used for this procedure. The former is usually infused in 50-60 ml quantities and the latter is infused in similar quantities, but repeated until the hydrogen peroxide no longer foams. Alternatively, 1-3 tubes of mastitis ointment can be infused, using the tube as an infusion device. The prepucis is usually infused 1-2 times daily until the infection clears up. Systemic antibiotics can also be administered in severe cases.

j) Traumatic injuries to the penis and prepuce

(i) Hair rings (etc.)

- generally seen in young bulls and results from homosexual activity
- the ring of hair around the penis may result in balanoposthitis. Less commonly, hair rings may lacerate the penis, cause a urethral fistula, or cause sloughing of the glans penis.
- in A.I. centres, a rubber band that has slipped off the artificial vagina will cause similar or more severe problems than hair rings.
- remove the hair ring and treat locally (and systemically, if necessary) as indicated
- if the glans penis has sloughed off, cull the bull. If he is valuable, collect semen by electroejaculation at an artificial insemination centre.

(ii) Avulsion of the prepuce

- occurs near its attachment to the penis
- usually occurs in bulls that are being collected with an artificial vagina
- if the condition is diagnosed on the day of its occurrence, it should be carefully sutured using 0 to 00 absorbable suture material and a swedged-on needle
- if the lesion is not fresh, it should be treated with local antibiotics as described under 'balanoposthitis'
- in any case, systemic antibiotics are indicated for 5 or more days and rest from sexual activity will be required until healing is complete
- a surgical technique for this condition is described in Current Therapy in Theriogenology 2 and Current Therapy in Large Animal Theriogenology and the condition is discussed more fully in Theriogenology 28:237-256, 1987.

(iii) Preputial injuries, lacerations, and prolapse

Pertinent anatomical features

- there is an elastic membrane that extends from the inguinal area to the prepuce and lies between the penis and prepuce when the penis is extended
- the protractor prepuce muscles originate from the cutaneous trunci muscles near the umbilicus and circumscribe the preputial orifice and

attach to the skin of the sheath. These muscles constrict the preputial orifice.

- the retractor prepuce muscles originate in the inguinal area and pass cranially to attach to the elastic membrane about 8 cm caudal to the preputial orifice. These muscles, along with the elastic membrane and retractor penis muscles, serve to retract the cranial portion of the prepuce. Also, with the protractor prepuce muscles, they serve to elevate the sheath.

Pathogenesis

- inherited deficiency of the retractor prepuce muscles in polled breeds, Brahmans, and possibly other breeds predisposes to protrusion of the prepuce from the sheath, usually when the bull is resting or undisturbed. This usually causes little problem by itself, but may predispose to trauma of the prepuce.
- cattle with Bos indicus breeding (e.g., Brahman, Santa Gertrudis) can have very loose hides which can result in a very pendulous sheath. These bulls also tend to have large preputial orifices and an excessive amount of preputial mucosa. These breeds are therefore predisposed to preputial prolapse and trauma.
- lacerations of the prepuce usually occur at breeding, and subsequently by damage from brush, etc. in the pasture. These lacerations are usually longitudinal and occur on the ventral prepuce.
- if the bull is unable to retract the prepuce after injury (most likely in bulls with poor retractor muscles, etc.), edema, inflammation, and infection occur and the trauma can be compounded. Edema will be more pronounced in bulls with pendulous sheaths.
- if the elastic layers of the prepuce are not damaged, the laceration may heal spontaneously, especially if the bull is removed from service for at least 6-8 weeks (depending on the severity of the lesion and how well it heals)
- if the elastic layers are involved, fibrosis will develop in these layers which will interfere with the ability of the penis to extend. Treatment (as described below) will therefore be required.
- if the lesion extends through the elastic tissue, contamination may spread caudally, resulting in phlegmon and necrosis and a poor prognosis.

Treatment

Laceration with phimosis

- the penis and prepuce cannot be extended out of the sheath because of stenosis at the laceration site. This stenosis can usually be felt by digital palpation.
- the prepuce should be flushed as described under 'balanoposthitis'. Local therapy may be required for 10-14 days. Systemic antibiotic therapy for at least 7 days is also indicated in most cases. Hydrotherapy can be used if the sheath is edematous.
- after 30 days of rest from sexual activity, the penis can be gently extended to determine the degree of stenosis; excessive force

should not be used to extend the penis. If healing is not complete, recheck in another 30 days.

- if the lesion heals improperly, or if the stenosis persists, surgical correction is required. The prepuce may be stenotic after surgery but the contracted elastic tissue will relax over time. It may take up to 6 months for complete healing to allow the penis to extend freely. For the surgical procedures, refer to Current Therapy in Theriogenology 2, Current Therapy in Large Animal Theriogenology, Large Animal Urogenital Surgery, Bovine and Equine Urogenital Surgery, other surgery textbooks, and the surgery notes.
- the prognosis for returning to breeding for bulls with preputial laceration and phimosis is good to guarded, unless abscesses form.

Injuries or laceration with prolapse

- most common in the polled and Bos indicus breeds
- clip the preputial hairs. Wash the surface of the prepuce and remove the necrotic debris. Some veterinarians will then soak the prolapsed portion for 30-90 minutes in warm magnesium sulphate solution in a plastic jug that has been cut in half and strapped around the abdomen of the bull. Most bulls will have to be restrained in a stock or chute for this procedure. Some clinicians prefer to remove edema from the prepuce by spraying it with water.
- massage the prolapse with ointment (2 gm tetracycline and 60 ml scarlet oil in 500 gm anhydrous lanolin) for at least 15-20 minutes to reduce the swelling and edema
- take a 12-20 cm long and 1.5-2.5 cm diameter piece of rubber or plastic tubing (e.g., stomach tube) and wrap one end with tape to form an enlargement. If desired, the tape can be covered with a finger from a rubber glove (tip removed) to keep it dry. Place the wrapped end of the tube inside the prepuce to act as a drainage tube.
- cover the prepuce with stockingette and tightly wrap it distally to proximally with elastic bandage. Be sure to anchor the tape to the haired skin of the sheath and to tape the protruding tip of the tube so that it doesn't fall out.
- this bandage should be changed every 24-48 hrs and the prepuce should be washed (and soaked as described above, if desired) and massaged with ointment until the swelling and edema are gone
- systemic antibiotic therapy may be indicated until any infection has been eliminated

- a periabdominal bandage or "bull diaper" has also been used, with or without the bandaging described above, in order to elevate the prepuce and thereby reduce edema. This bandage requires washing at least once a day to remove urine. If the prepuce is not wrapped, it should be washed and massaged with ointment daily.
- once the prolapsed prepuce can be replaced (which may take weeks in severe cases), the diameter of the preputial orifice can be reduced by wrapping a piece of white tape around it (this may work better if the area is clipped first). A 2.5 cm diameter piece of Penrose drain can be sutured over the end of the penis to protect the wound from urine. The drain is sutured to the skin of the free portion of the penis with 4 to 6 interrupted sutures of 0 to 00 absorbable suture material (making sure to avoid the urethra and corpus spongiosum penis). The Penrose drain can be removed when it is no longer needed. A (perhaps less desirable) alternative is to use elastic tape to tape in the rubber or plastic urine drainage tube (described above) and change this 'bandage' at least once or twice weekly.
- if granulation tissue or fibrous tissue prevent replacement of the prolapse, they can be debrided with scissors along the wound edges after the edema and infection have been eliminated. The prolapse can then be replaced and held in place as described above.
- after replacement, the prolapse is treated as for laceration with phimosis
- once all evidence of edema and infection has disappeared (may take 6-8 weeks after the prepuce was replaced), surgery can be considered. Surgery might be necessary to remove the stenotic or fibrotic portion of the prolapse. If the longitudinal laceration has healed transversely, the prepuce will be shortened and have a pendulous portion. This too, usually requires surgical correction. Removal of the excessive preputial mucosa on Bos indicus bulls or removing some skin to make their prepuce less pendulous may prevent recurrence, although breeders should be encouraged to select against bulls with very pendulous prepuces. Especially in Bos taurus bulls, one must be careful not to remove too much preputial mucosa or the penis will not extend far enough. One reference states that the remaining portion of the preputial membrane should be at least slightly longer than twice the length of the free portion of the penis. The surgical procedures used (reefing operation and

amputation of the affected portion of the prepuce) are described in the references listed under 'laceration with phimosis'.

- the prognosis for returning to breeding for most bulls with injuries or lacerations with prolapse of the prepuce is good to guarded, depending on the severity. However, if there is severe edema, a deep laceration, or deep necrosis and fibrosis, the prognosis is guarded to poor.

(iv) Retropreputial abscess

- may not be apparent until about 3 weeks after the injury
- most often occurs with preputial laceration and phimosis and may occur proximal to the laceration due to migration
- if at all possible, the abscess should be drained or dissected out (through the original laceration, if close to it) into the preputial cavity. This should be followed by flushing the prepuce as described under 'balanoposthitis'. Warm water hydrotherapy (e.g., 30-60 minutes BID) can be administered for as long as required. Systemic antibiotics for 5-14 days are often indicated.
- aspiration or drainage of the abscess through the skin of the sheath is not recommended; this can create adhesions from the elastic membrane to the skin of the sheath. If the abscess cannot be drained from inside the preputial cavity, conservative therapy (systemic antibiotics, hydrotherapy, and rest from sexual activity) may be the best option for resolution of the scar tissue. This resolution may take several months, if it occurs at all.
- one can attempt to remove any adhesions caused by the abscess after all indications of active infection have subsided (generally ≥ 30 days). However, this treatment is seldom successful.
- the prognosis for returning to breeding for bulls with abscess of the prepuce is usually poor. Refer to Large Animal Urogenital Surgery, Bovine and Equine Urogenital Surgery, and other textbooks for further details on this condition.

(v) Contusions of the penis and prepuce and lacerations of the penis

- if the penis is not deeply lacerated and sensation is not lost, the prognosis is good to guarded
- often results in swelling and paraphimosis (inability to retract the penis)
- the penis and prepuce should be washed, ointment (see formula under 'injuries or laceration with prolapse') should be massaged in, and if possible, the penis and prepuce should be returned to the

sheath. The preputial orifice can then be taped as described under 'injuries or laceration with prolapse' and flushed 1-2 times daily as described under 'balanoposthitis'.

- if the penis cannot be replaced into the sheath, the penis and prepuce can be wrapped with stockingette and the proximal portion taped. Do not tape so tight that blood flow is shut off to the end of the penis. This bandage can be removed daily and the penis can be washed and massaged with ointment (see 'injuries or laceration with prolapse') until it will retract.
- systemic antibiotics should be administered when indicated.

k) Congenitally short penis

- most common in bulls, but also reported in bucks, boars, and stallions
- possibly recessive inheritance in bulls
- the bull maybe able to copulate when he is young, even though only 6-22 cm of the erect penis protrudes from the sheath. As he gets older, the abdomen becomes deeper and the bull less agile, and he is unable to breed.
- in bulls (and possibly bucks and boars) with this condition, the sigmoid flexure may not form a sharp S in the resting state
- this condition is probably best diagnosed by observation at breeding. If this is not possible, it has been suggested that a general anesthetic or an internal pudendal nerve block (ref. - Vet Med/Small Anim Clinician 75:1432-1438, 1980) be administered to bulls in order to completely relax the penis. If the length of the extended penis is < 25 cm from the tip to the preputial orifice, the penis of the bull is too short.
- this condition needs to be differentiated from cavernosal venous shunts, short retractor penis muscles, occlusion or thrombosis of the corpus cavernosum penis, adhesions of the penis, etc.

2) Stallion

a) Traumatic injuries

- from fences, kicks, breeding accidents, whips, the improper use of penile rings (stallion rings) or abdominal brushes to prevent masturbation, or running through tall, thick, brush
- in all cases of trauma to the penis, make certain that urine output is normal.

(i) Lacerations

- suture wounds when indicated

- treat topically and enforce rest from sexual activity
 - light exercise may diminish swelling due to edema
 - systemic antibiotics and/or tetanus prophylaxis may be indicated.
- (ii) Constrictive fibrosis
- from a chronically tight stallion ring or traumatic injury
 - can interfere with normal erection and "flowering" of the glans penis. The stallion may therefore be unable to breed.
- (iii) Hematomas
- the hemorrhage is usually from subcutaneous vessels outside the corpus cavernosum penis (ccp)
 - a large swelling develops over the traumatized area, the penis cannot be retracted and swelling and edema result. Secondary thrombosis of the veins and lymphatics may result.

Treatment

- analgesics, diuretics (if urine output is not compromised), and non-steroidal anti-inflammatories (e.g., flunixin meglumine or phenylbutazone) should be used as indicated. Sedatives should only be administered if they are essential to ensure operator safety. Phenothiazine tranquilizers are contraindicated (see 'paralysis and priapism') and xylazine is known to increase urine production.
- tetanus prophylaxis should be administered and systemic antibiotics will be required during the treatment period. Antibiotics are often applied locally if the epithelium has been damaged.
- hydrotherapy (e.g., 60 minutes SID, further details under 'hematomas in bulls'), massage with ointments, and pressure bandages (not **too** tight) are used to reduce the swelling and edema. Some authors suggest repeatedly applying pressure bandages and massaging the penis through the bandages to reduce the edema before applying a longer-term bandage. The penis should be coated with an emollient to prevent drying and cracking of the epithelium. The bandages should be removed and the penis treated once or twice daily.
- in order to control edema, the penis should be suspended close to the abdominal wall with a periabdominal bandage or the method described on page 643 of Current Therapy in Theriogenology 2
- monitor the stallion's ability to urinate and palpate the bladder as needed to check for excessive distension. Catheterize the bladder if necessary. (This may be made necessary when pressure

bandages are applied.) A perineal urethostomy may be required in cases of urethral blockage where a catheter cannot be passed.

- when the swelling is sufficiently reduced, the penis can be replaced into the prepuce, usually under general anesthesia. (A preputiotomy may be indicated if the preputial ring is acting as a constricting band.) A purse-string suture that allows a 2-finger opening in the preputial orifice may be required to keep the penis in place. The suture should be removed in 4-10 days. Alternatively, the penis can be retained in the sheath by a nylon net or pantyhose that has been suspended at the preputial orifice by rubber tubing. In either case, the penis should be cleaned and evaluated daily.
- freedom from sexual stimuli is essential for at least 6 weeks until recovery is complete
- in some cases, the innervation to the penis may be damaged which can inhibit ejaculation
- if there is excessive necrosis of the penis, amputation may be necessary. If paralysis of the penis persists, amputation or surgical retraction may be necessary. Whenever possible, the stallion should be castrated and the castration incisions allowed to heal prior to amputation or surgical retraction of the penis. Circumcision (the reefing operation) may be required if there is excessive preputial scarring. These procedures are described in Current Therapy in Theriogenology 2, Equine Reproduction, Large Animal Urogenital Surgery, Bovine and Equine Urogenital Surgery, other surgery textbooks, etc. Persistent and extensive medical therapy should precede a decision to perform any of these surgeries.

b) Paralysis of the penis (and priapism)

Etiology

- damage to sacral nerves 3-4, spinal disease
- infectious causes, e.g., equine rhinopneumonitis (equine herpesvirus myeloencephalitis), equine infectious anemia, dourine, rabies
- severe debilitation, purpura hemorrhagica
- long-acting phenothiazine tranquilizers (not commonly used now), and possibly short-acting tranquilizers (e.g., acepromazine) can cause priapism (persistent erection without sexual arousal) as well as penile paralysis. Reserpine has been reported to cause penile paralysis in a stallion when used for a prolonged period in order to modify his behavior. Etorphine has also been reported to be a cause of penile paralysis or

priapism in the horse. Priapism has been reported after general anesthesia.

- trauma to the penis
- certain toxicoses
- starvation/exhaustion
- complication of post-castration edema or infection.

Pathogenesis and clinical signs of penile paralysis

- not well understood
- tranquilizers cause blood stasis in the corpus cavernosum penis (ccp) and may result in loss of vascular tone. Tranquilizers relax the smooth muscles of the ccp as well as the retractor penis muscles.
- nerve damage can result in loss of muscular tone
- thrombosis and fibrosis of the ccp eventually results
- the paralysed penis is often extended and flaccid
- libido may be maintained, but complete erection is unlikely
- eventually edema of the penis and drying of the epithelium occur.

Treatment

- benztropine mesylate (= Cogentin - has anticholinergic and antihistaminic effects) @ 8 mg (0.015 mg/kg) and possibly other, similar drugs (see J Amer Vet Med Assoc 199:1183-1184, 1991) by slow IV injection has been reported to be successful in treating anesthetic or tranquilizer-induced paralysis or priapism if administered very early in the course of the disease (e.g., first 6 hours; prior to blockage of the venous drainage by clots)
- prevent and treat swelling and edema as described under 'hematomas'
- cleaning and replacing the paralysed penis into the prepuce and retaining it there as described under 'hematomas' may be beneficial. However, the horse may not regain the ability to retract the penis and it often prolapses again after the retention device is removed.
- stallions with penile paralysis may sometimes be collected with an artificial vagina (stallions with partial erection failure) or by the use of hot, wet compresses or moist heat therapy packs applied to the base of the penis while the stallion is mounted on a mare or phantom mare (stallions with complete erection failure). For more information on this, refer to "Managing stallions with a paralysed penis for return to natural service and AI", Proc. American Assoc. of Equine Practitioners, 2003, pp 291-292. Alternative methods of collecting stallions are also discussed in *A Manual for Theriogenology* under 'Semen Collection'. Collection by electroejaculation under general anesthesia can also be attempted on a limited basis (may be a danger of tearing the rectum with the probe). Ex copula ejaculation

could also be attempted using imipramine and xylazine (Proc. Soc. for Therio., 1998, pp 59-62, Proc. American Assoc. of Equine Practitioners, 1998, pp 12-15 and Anim. Reprod. Sci. 68:153-159, 2001).

- penile amputation or surgical retraction of the penis is often resorted to and these generally need to be preceded by castration. (Refer to the references listed under 'hematomas'.)
- for priapism, the horse can be placed in dorsal recumbency under general anesthetic and the penis manually compressed (including percutaneous compression of the postscrotal portion) in order to force the blood out of it and reduce it back into the prepuce. If there is no success with this treatment, consider aspiration and irrigation of the corpus cavernosum penis with heparinized saline or heparinized lactated Ringer's solution (10 units Na heparin per ml fluid) to evacuate the sludged blood. The horse must be placed in dorsal recumbency under general anesthetic and the penis and inguinal area prepared for aseptic surgery. Several litres of solution are flushed under pressure through the ccp using a 12 g needle inserted into the ccp proximal to the corona glandis. The fluids are exited through 1-2 12 g needles inserted into the ccp 10-15 cm caudal to the base of the scrotum. The ccp is flushed until hopefully, fresh blood appears in the efflux. The irrigation is repeated daily, if warranted. The details of this treatment are discussed in the references at the end of this section and in Current Therapy in Large Animal Theriogenology. The latter reference also describes surgical therapy which involves creating a venous shunt between the corpus cavernosum penis and the corpus spongiosum penis. If paralysis of the penis results, treat as described previously.

c) Neoplasms

- squamous cell carcinoma is the most common. Geldings may be predisposed because they do not protrude the penis as much as stallions and therefore may develop more smegma and moisture in the prepuce resulting in increased irritation to the penis. If this occurs, regular cleaning of the penis or even therapy with testosterone may alleviate the problem.
- squamous cell carcinomas first appear as plaques and later are ulcerative or cauliflower-like. They are locally invasive but seldom metastasize. Biopsy of the lesion should be diagnostic. Early cases can be removed by excision, cryosurgery, or hyperthermia; however, they may recur. Topical application of 5% 5-fluorouracil every 2 weeks (wear gloves!), combined with surgical debulking of the tumor (if necessary) has been reported as a successful treatment (J Am Vet Med Assoc 205:1183-1185, 1994). Advanced cases will require the reefing operation or amputation of the

penis and possibly removal of the superficial inguinal lymph nodes (see references under 'hematomas').

- other neoplasms of the penis and prepuce include: squamous papillomas (probably of viral origin and self-limiting), sarcoids, hemangiomas, and melanomas.

d) Habronemiasis (summer sores)

- granulomatous lesion(s) around the larvae of Habronema spp. and Draschia spp., which are stomach worms of horses. Flies are the intermediate host. These lesions can appear on various parts of the body including the penis and prepuce.
- a biopsy may be necessary to distinguish it from a neoplasm
- may disappear in winter and the condition has become uncommon since the routine use of ivermectin as an antihelminthic
- therapeutic regimens are described in *A Manual for Theriogenology* and oral trichlorphon has been used as well at the calculated anthelmintic dose. More recently, ivermectin at 0.2 mg/kg orally has been effective. Affected stallions can be treated monthly, as needed, or treated three times at 10-day intervals for severe lesions. There may be temporary exacerbation of the lesions from the reaction to the dying larvae. Corticosteroids can be administered (e.g., prednisolone p.o. @ 1.5 mg/kg S.I.D. for 10-14 days) in order to reduce the inflammatory reaction. Surgical excision, cryotherapy [ref. - American College of Theriogenologists (ACT), Society for Theriogenology (SFT), American Association of Equine Practitioners (AAEP), Proceedings of the Stallion Reproduction Symposium, pp 84-94, 1998] thermocautery, or the reefing operation (see references listed previously) may occasionally be required to remove excessive granulation tissue. If excessive scarring results, the reefing operation or other surgical intervention may be required.
- amputation of the urethral process may be necessary if excessive periurethral fibrosis occurs.

e) Equine coital exanthema

- caused by equine herpesvirus-3, which does not cause abortions, respiratory infections, etc. as do other strains of EHV
- venereal transmission by symptomatic or asymptomatic carriers and possibly by other means as well
- nodules, vesicles, pustules, scabby erosions or ulcers appear on the vulva of the mare or penis and prepuce of the stallion. These lesions may inhibit breeding or cause discomfort during urination, but probably do not affect

fertility directly. The occasional stallion may show dullness, anorexia and fever.

- the diagnosis is usually based on clinical signs but virus isolation, cytology (for herpesvirus inclusion bodies) or serology can also be used
- therapy includes rest from sexual activity for 3 to 5 weeks and the topical application of oily antibiotic preparations. If necessary, and if artificial insemination can be used, semen can be collected with an open-ended artificial vagina after the lesions are no longer painful.
- the lesions usually heal within 10-35 days, but may leave depigmented areas. Immunity is not permanent but usually lasts through the breeding season during which the condition was diagnosed.

f) Dourine

- caused by the protozoan, Trypanosoma equiperdum, which has been eradicated from North America
- venereal transmission, some inapparent carriers
- causes swelling and edema of the external genitalia of both sexes and mucopurulent discharge, intermittent pyrexia, nervous signs, incoordination, emaciation etc. Two to 10 cm diameter plaques eventually form on the skin, especially on the lower body parts. When the plaques disappear, they can leave depigmented areas of the skin. The disease can be acute or chronic.

g) Hemospermia

- can be the result of some of the external lesions already described, from seminal vesiculitis (discussed later), or from the urethra. When natural breeding is used, one must make certain that the source of hemorrhage is not the mare's vagina.
- urethral hemorrhage is most often seen in stallions with heavy usage and they may show some pain and reluctance to breed. Urethral hemorrhage can be the result of urethritis, urethral ulceration, prolapsed subepithelial vessels, neoplasia, and urethral strictures. Inflammation most often occurs in the proximal urethra.
- hemospermia may also be transient and of unknown etiology
- if the red blood cells are numerous, they may reduce the fertility of the semen
- the condition is most apparent when the stallion is collected with an artificial vagina
- the cause of hemospermia is investigated by careful examination of the penis, culture of the semen and urethra, endoscopic examination of the urethra (an endoscope > 100 cm in length is usually required), and double

contrast radiography of the urethra. The latter technique is described in *A Manual for Theriogenology*.

- treatment consists of rest from sexual activity for 4-8 weeks and about 2 weeks of systemic antibiotic therapy, based on the sensitivity of isolated bacteria. Urethral antibiotic suppositories and oral urinary acidifiers have also been advocated by some. Some authors recommend administering the antibiotic suppositories twice daily through a subischial (perineal) urethrostomy incision. Alternatively, an 8-10 cm incision down to the urethral mucosa in the area of the ischial arch has been advocated. This is followed by at least 3 months of rest from sexual activity. The incision site might bleed for more than a week following surgery but heals by second intention in about 3 weeks. It is postulated that this surgery decreases cavernosal pressure on the lesion caused by urination and thus promotes healing (ref. - Current Therapy in Large Animal Theriogenology).

- an open-ended artificial vagina could be used to collect the sperm-rich fraction if it is ejaculated separately from the hemorrhagic portion. Temporary urinary diversion via an indwelling bladder catheter placed through a urethrostomy incision will decrease urine irritation of the site. Hypotensive agents (e.g., isoxsuprine HCl) have also been suggested for the treatment of this condition. Furosemide diuretic administered IV one hour prior to collection has also been suggested to be helpful.

h) Varicosities of the preputial veins

- seen occasionally, especially in young colts
- do not interfere with breeding.

i) Venereal diseases for which stallions are lesionless carriers

Ref. - ACT, SFT, AAEP, Proceedings of the Stallion Reproduction Symposium, pp 76-83, 1998.

- (i) Contagious equine metritis
 - refer to *A Manual for Theriogenology* (for reference only).

- (ii) Equine viral arteritis (EVA)
 - most prevalent in Standardbreds
 - stallions can become persistently infected inapparent carriers and constantly shed the virus in their semen. Persistent shedders apparently harbor the virus in their accessory sex glands, ampullae and ductus deferens. A limited number of persistently infected

stallions cease shedding after one to several years (or possibly less for some stallions). Stallions may exhibit a temporary decline in fertility shortly after exposure to the virus (perhaps due to fever or occasionally, scrotal edema). One report states that 30-60% of seropositive mature stallions shed the virus in their semen.

- stallions that have tested positive for EVA may have to undergo test matings to 2 seronegative mares and these mares are tested for serum antibodies 21 days later. The American Association of Equine Practitioners (AAEP) has a comprehensive set of guidelines to control the venereal spread of this disease. Details are available on the AAEP website (www.aaep.org) under 'Ethics and Professional Guidelines'.
- recently it has been found that if the samples are collected and handled properly, the virus can be isolated from the semen when the stallion is a shedder. If the necessary facilities are available and the sample is handled and shipped properly (see Proceedings reference above), virus isolation can replace test mating. Virus can also be detected in the semen by reverse transcription-polymerase chain reaction (RT-PCR).
- to prevent the carrier state, annual vaccination of seronegative stallions with "Arvac" (Ayerst/Fort Dodge Laboratories) is recommended. However, the seronegative status of the stallion must be certified before vaccination to avoid confusing the titre from the vaccine with a titre from infection.
- for more details on EVA infection in the stallion, refer to Proc. Soc. for Therio., 1991, pp. 151-157
- for details on the effects of this disease on reproduction in the mare, refer to *A Manual for Theriogenology*. Mares infected by shedding stallions can shed the virus to their pregnant herd mates, possibly resulting in abortions.

(iii) Klebsiella pneumoniae and Pseudomonas aeruginosa

- 30 to 40% of normal stallions can shed these and other organisms in semen and still have normal fertility levels. However, the isolation of potentially pathogenic organisms from the reproductive tract should be noted in the event that bacterial infertility is detected in mares served by a particular stallion.
- occasionally, a very pathogenic strain of these organisms (or possibly a virulent strain of Streptococcus zooepidemicus) will be present on the penis and prepuce of a stallion and cause infertility in the mares that he breeds. (Much less commonly, these

organisms may also be present in the genital tract.) It has been suggested that the growth of pathogenic bacteria on the penis of stallions is encouraged by washing it with antiseptic soaps, thus eliminating normal bacterial flora.

- in order to confirm that a stallion is a lesionless carrier of a pathogen, one should be able to isolate large numbers of the organism from various sites on the external genital organs (prepuce, fossa glandis, and urethra) on ≥ 3 separate occasions. One should also be able to demonstrate that the same organism isolated from the stallion [i.e., same serotype of Pseudomonas or same capsule type (usually 1, 2 or 5) of Klebsiella] is causing endometritis in mares. The endometritis should be diagnosed by serial isolation of large numbers of the organism in relatively pure culture from uteri, as well as demonstration of inflammation in the uteri, decreased conception rates, etc. Alternatively, the stallion can be test mated to maiden mares which are examined for pregnancy by ultrasonography 12-15 days post-breeding. If these mares develop a vaginal discharge, one should be able to culture the same organism that was cultured from the stallion.
- the elimination of these pathogenic organisms from the stallion's genital tract is difficult. Systemic therapy is probably ineffective. Various methods of topical therapy have been recommended for eliminating pathogenic organisms from the surface of the penis and prepuce. These include the application of aminoglycoside antibiotic ointments and/or a prolonged course (> 30 days) of treatment with 1% silver nitrate solution, washing with an iodine-based surgical scrub followed by the application of 1% silver sulfadiazine cream, or the use of 10 ml concentrated 38% HCl/4 litres of water (for Pseudomonas) or 40-45 ml 5.25% Na hypochlorite (bleach)/4 litres of water (for Klebsiella). Unless otherwise stated, the treatments usually occur daily for approximately 2 weeks (refer to Vet Clinics of N.A.: Equine Practice 8:197-198, 1992 for details, especially on using surgical scrub/silver sulfadiazine, HCl and Na hypochlorite). (Pseudomonas organisms can be detected on the penis and prepuce because they fluoresce a bright blue-green when examined under an ultraviolet light in a semi-dark room.) Applying antibiotic ointments etc. may cause irritation of the penis, the elimination of normal bacteria, and the proliferation of similar or more resistant species. Applications of normal commensal bacteria after treatment are recommended to prevent recolonization by pathogens. This may be achieved by taking normal smegma, mixing it with petrolatum

jelly, and smearing it over the erect penis. Another method is to repeatedly apply a broth culture of penile and clitoral commensal bacteria. These applications are followed by a period of rest from sexual activity and the efficacy is monitored by repeated post-treatment cultures.

- if the use of artificial insemination is permitted, the infected semen can be treated with semen extender containing the appropriate antibiotics. Incubation of the semen at room temperature in the extender for at least 30 minutes may be necessary to destroy the offending bacteria. Contamination of the ejaculate can also be reduced by using an open-ended artificial vagina to collect only the sperm-rich fraction.
- if A.I. is not permitted, the infusion of 60-100 ml of pre-warmed, antibiotic treated semen extender into the uterus of the mare prior to breeding may be helpful. However, the results from this practice have been equivocal and excessive dilution of the semen can reduce fertility. Another untested suggestion is to lavage the uterus with warm saline approximately (but not less than) 4 hours post-breeding (uterine lavage will be discussed in more detail under 'endometritis' in VHM 321). The number of breedings per mare should be kept to a minimum, especially when A.I. is not used.
- for more information on the 'minimal contamination technique' for breeding mares refer to Veterinary Obstetrics and Genital Diseases (Theriogenology), pages 615-616.

Useful references that discuss a number of conditions affecting the penis and prepuce of the stallion as well as describing medical and surgical therapy are: Surgery of the penis and prepuce, Vet Clinics of N.A.: Equine Practice 4:473-491, 1988 and two articles in The Compendium on Continuing Education for the Practicing Veterinarian 11:1498-1509, 1989.

3) Boar

a) Persistent frenulum

- also occurs in boars as it does in bulls.

b) Traumatic injuries

- abrasions or lacerations can result from friction from the hair on the sow's rump or from bites from sows or other boars
- occasionally, the tip of the penis can be amputated (bitten off) and the boar will not be able to copulate

- hematuria and/or hemospermia may be noted
- urethral polyps or ulcers may result from the injury. Double-contrast radiography may be needed to diagnose these conditions.
- if a urethral fistula develops, it may require surgical closure to prevent semen from being ejaculated too far caudally in the vagina
- occasionally, penile deviations will result from scar tissue formation
- treatment of injuries to the penis and prepuce is similar to that in the bull, but the preputial diverticulum will have to be kept empty by expressing it regularly during the treatment period.
- ref. - Proceedings of the Swine Reproduction Symposium, ACT, SFT and AASP, 1996, pp 36-41.

c) Foreign bodies in the prepuce

- originate from the bedding, etc.
- can cause irritation, and occasionally, phimosis
- general anesthesia maybe necessary to remove these foreign bodies. Any balanoposthitis should be treated as well.

d) Conditions involving the preputial diverticulum

- the preputial diverticulum consists of two indistinctly separated sacs dorsal to the cranial preputial cavity, with a common access to the preputial cavity. There is a normal narrowing of the preputial cavity just caudal to the opening of the diverticulum.
- problems encountered with the preputial diverticulum:
 - (i) Dilation with urine retention, calculi, etc.
 - (ii) Inflammation, ulcers, and bleeding ulcers. The penis may be involved as well (= balanoposthitis). There may also be urogenital infections in the sow herd and infected boars may spread the organisms further at breeding.
 - (iii) Habitual ejaculation into the preputial diverticulum. The penis "balls up" inside the diverticulum instead of extending normally.

Treatment

- balanoposthitis can be treated locally by flushing the prepuce and preputial diverticulum with nonirritating antibiotic or antiseptic solutions. Sows affected with urogenital infections are treated with systemic antibiotics. Affected animals can also be culled and animals should not be purchased from affected herds. Improving overall sanitation as well as increased sanitation at breeding are preventative. Water availability and quality, ration

quality, ambient temperatures, stress, housing and exercise should all be evaluated.

- the most permanent and effective therapy for these conditions in the individual boar may be to surgically remove the diverticulum. A procedure for this is described in *A Manual for Theriogenology, Large Animal Urogenital Surgery*, and in recent editions of *Diseases of Swine*. An alternative, rapid, and less surgically invasive procedure has been described in J Amer Vet Med Assoc 205:92-96, 1994.

e) Preputial prolapse

- not common in boars
- may result from trauma
- the treatment is similar to that in bulls (also, see reference under 'traumatic injuries').

f) Penile hypoplasia, cavernosal venous shunt complex

- results in partial erection of a small penis
- is a permanent unsoundness.

4) Ram and Buck

a) Congenital phimosis in rams

- is a permanent unsoundness

b) Enzootic balanoposthitis ("pizzle rot")

- occurs in rams and castrated male sheep and goats (wethers), and can occasionally affect steers, bulls, or the vulva of ewes
- results from high protein diets. The causative bacteria (*Corynebacterium renale*) breaks down the urea in the prepuce to ammonia, which causes ulceration.
- discomfort and reduced libido can result, and phimosis can occur in severe cases
- the condition can often be controlled by temporarily restricting the diet, supplying ad libitum water, trimming the wool around the prepuce, etc., disposing of all infected materials, and isolating affected animals. Increasing the amount of grass hay in the diet and decreasing the amount of legume will also be beneficial.
- individual animals can be treated by cleaning the affected area and applying topical antibacterial ointment as needed. Ammonium chloride per os @ 1-3 gm, 2-3 times daily, will help to acidify the urine and therefore may be beneficial.

c) Ulcerative dermatosis of sheep

- caused by a virus similar to the one that causes contagious ecthyma (sore mouth)
- described in the western U.S.A., Europe, and South Africa
- transmitted by physical contact, probably through a break in the skin or mucous membranes
- causes ulcers of the lips, face, legs, feet, and external genital organs of both sexes (i.e., deeper lesions than for contagious ecthyma, which has not been reported to affect the genitals)
- no vaccine or effective therapy; therefore, control by management.

d) Damage to the urethral process

- a result of inflammation and necrosis, amputation for the removal of calculi, shearing accident, etc.
- may not significantly affect fertility if it is absent, but should be noted when evaluating a valuable ram.

e) Intersexes

- relatively common in polled goats
- refer to *A Manual for Theriogenology* under 'Infertility and Abortion in the Doe'. This is required reading.

5) Dog

a) Balanoposthitis

- can be caused by herpesvirus, but more often are associated with microorganisms that normally inhabit the prepuce. Trauma, foreign bodies, neoplasia, urinary incontinence, allergic dermatitis, rubber bands around the penis, etc. can also cause this condition.
- purulent discharge from the prepuce may be noted but one must keep in mind that normal dogs can have some discharge without inflammation being present
- treatment involves the daily application of mastitis ointments and, if necessary, systemic antibiotics.

b) Paraphimosis

- may follow normal copulation or maybe the result of a constriction such as band of hair at the preputial opening or a rubber band, etc. around the penis
- treatment involves cleansing and lubricating the penis and replacing it into the prepuce. Surgical enlargement of the preputial orifice might be required to achieve this in some cases. This is accomplished by a longitudinal incision that extends caudally from the ventral preputial orifice. After the penis has been replaced, the layers of the incision can be closed in a routine manner. Alternatively, the mucosa can be sutured to the skin on the cranial 0.5-1 cm of the incision in order to create a larger opening at the preputial orifice. Treat any inflammation as described under 'balanoposthitis'.
- one should always be certain that the penis returns to the prepuce after breeding or semen collection.
- occasionally, a dog might exhibit **persistent protrusion of the penis** that is not associated with erection. This may only occur when the dog sits. The penis may be too long or the prepuce too short. This seldom causes serious problems but drying of the penile mucosa or trauma to the penis may necessitate local treatment. If serious problems arise, castration may help or amputation of the distal penis may be necessary. Surgery to pull the prepuce forward is usually unsuccessful.

c) Urethral prolapse

- not common. Higher incidence in English bulldogs and Boston terriers.
- excessive sexual excitement or straining to urinate (often from urogenital infection) may cause prolapse of the distal urethra. It may also be idiopathic.
- edema and possibly bleeding of the prolapsed portion result. Some dogs may lick the prepuce excessively but others show no signs.
- the urethra may be replaced if it is not damaged, and retained with a purse-string suture for 5 days. Castration may prevent recurrence. A technique to reduce the prolapse and retain it with urethropexy has been described in J. Amer. Anim. Hosp. Assoc. 38:381-384, 2002. Resection of the prolapse and anastomosis of the urethral and penile mucosa is more likely to be effective long-term than simple replacement of the prolapse. Amputation of the distal penis may be necessary when there is marked trauma or the problem is recurrent.

d) Trauma to the penis

- from accidents or fight wounds

- may result in pain, irritation, and/or hemorrhage
- apply local pressure to control hemorrhage, then clean, debride, and suture as necessary
- monitor urine output and catheterize the bladder, if necessary
- extrude the penis at least 1-2X daily thereafter in order to apply antibiotic ointment and prevent the formation of adhesions. This therapy may have to be continued for 10-12 days. Systemic antibiotics may be indicated in certain cases.

e) Fracture of the os penis

- most often occurs when the animal attempts to jump a barrier
- presenting signs include pain, depression, and variable signs relating to the urethra, depending on the amount of urethral involvement
- urethral catheterization and radiography (including retrograde urethrography, if necessary) are used to aid in the diagnostic work-up
- surgery will be necessary if the urethra is not intact or if there is sufficient bone displacement. This consists of fracture reduction or even amputation of the penis (refer to surgery notes and textbooks).

f) Congenital defects

- these include persistent frenulum, hypoplasia, preputial stenosis with phimosis, duplication of the penis and prepuce, and hypospadias (abnormal ventral opening in the extrapelvic urethra)
- refer to the appropriate reference textbooks for details.

g) Transmissible venereal tumor

- coitally transmitted tumor that affects the external genitalia of either sex. The disease can also be transmitted by licking, biting or scratching and can occasionally affect the skin, face, buccal cavity, nasal passages and perhaps, rectum. Infection probably occurs by whole cell implantation on the damaged mucous membrane of a susceptible (probably immunosuppressed) host.
- worldwide distribution, but is more prevalent in large cities and in tropical and warm temperate zones; rare in Canada
- can range in size from a small nodule to 10-15 cm in diameter
- they are firm but friable and may be ulcerated and inflamed on the surface. Metastatic rate is up to 17% and is generally to the regional lymph nodes, tonsil, eye, skin and subcutis, kidney, liver, spleen, brain, spine, or nasal passages. Histopathology and cytology (a fine needle aspirate and impression smears are preferred by some) are necessary to make the diagnosis. Chromosomal analysis will reveal only 59 ± 5 chromosomes in

contrast to 78 for the normal dog. The tumor must be differentiated from granulomas and other tumors of the penis such as squamous cell carcinoma, etc.

- may see a serosanguineous or hemorrhagic discharge from the prepuce or vulva, licking of the genitals, or protrusion of a mass
- frequent spontaneous regression has been reported and may occur in 2-6 months. However, this has been poorly documented and more cases of metastasis are being reported recently. The disease can be progressive.
- for nonmetastatic tumors, weekly IV injections of vincristine @ 0.025 mg/kg (or 0.8 mg/m² of body surface) for 2-7 weeks (until there is no visible evidence of disease) has been an effective therapy. For metastatic tumors, vincristine, cyclophosphamide and methotrexate in combination have been used. Surgical removal of tumors requires resection with wide margins (and can be supplemented with chemotherapy). Recurrence rate within six months after surgical removal alone ranges from 30-40%. Other methods of therapy are discussed in the appropriate reference textbooks and The Compendium on Continuing Education for the Practicing Veterinarian 19:1036-1045, 1997.
- **other tumors of the penis** include squamous cell carcinoma, malignant mast cell tumor and chondrosarcoma of the os penis.

h) Retrograde flow of spermatozoa and retrograde ejaculation into the urinary bladder

- the retrograde flow of a portion of the ejaculate into the bladder has been reported in male dogs during manual semen collection and in males of other species during electroejaculation or ejaculation. Xylazine also causes the retrograde flow of spermatozoa into the bladder of sexually rested dogs.
- retrograde ejaculation into the bladder of all spermatozoa released during emission has been reported during coitus in man and also in dogs and in a stallion. This results in azoospermia or no ejaculate at all and there is a relatively high concentration of sperm in the urine in the bladder.
- if one wishes to try and use a dog with retrograde ejaculation for breeding, the bladder should be catheterized, emptied and rinsed, and semen extender should be instilled into it just prior to semen collection. After the dog has been ejaculated, the bladder can be recatheterized and the extended semen retrieved for insemination of the bitch.
- other possible treatments include: ejaculation when the bladder is full or using alpha-adrenergic agonists (e.g., pseudoephedrine HCl @ 4-5 mg/kg PO TID or 1 and 3 hours before semen collection or breeding, or

phenylpropanolamine @ 3 mg/kg PO BID) to promote emission of semen into the prostatic urethra and closure of the bladder sphincter.

- refs. - Can Vet J 33:53-55, 1992 and Theriogenology 41:593-600, 1994.

Reference - Disorders of the canine penis, Proc. Soc. for Therio., 2000, pp 329-332.

6) Tomcat

- other than urinary calculi, penile hair rings are probably the most common pathological condition affecting the penis of the cat.

Accessory Sex Glands

1) Seminal vesiculitis (vesicular adenitis)

a) Bulls

- seen primarily in young bulls, housed in groups, and on a high nutritional plane. May be predisposed by stress, homosexual activity, etc.
- also occurs sporadically in older bulls, or chronic lesions might be discovered from an earlier infection
- the most common organism involved is Arcanobacterium (Actinomyces) pyogenes, and it is suspected that gram-negative anaerobes may accompany these bacteria. It is possible that these organisms might spread to the seminal vesicles (SVs) (=vesicular glands) by the hematogenous route from lesions of rumenitis that often occur in cattle on a high nutritional plane. (Similar pathogenesis to liver abscesses, etc.)
- Brucella abortus may also be involved in countries where the disease is not eradicated
- Streptococci, Staphylococci, E. coli, Pseudomonas, Proteus, Corynebacterium renale, Haemophilus somnus, Chlamydia/Chlamydia, Tritrichomonas foetus (?), mycoplasmas, ureaplasmas, various viruses, etc. have all been implicated as etiologic agents
- besides the hematogenous route, these organisms might reach the SVs as a descending infection from epididymitis, urinary tract infections, etc.
- ascending infections via the urethra seem unlikely and direct invasion of the glands from local sources probably occurs only rarely
- affected bulls have a higher incidence of malformations involving the colliculus seminalis, which may allow organisms, semen, or urine to enter the SVs. Reflux of urine or semen into the vesicular glands could cause a chemical irritation.

Diagnosis

- in rare cases, a bull may exhibit clinical signs similar to those observed with traumatic reticuloperitonitis or peritonitis. However, most affected bulls show no signs of systemic illness.
- may be accompanied by detectable or undetectable inflammation elsewhere in the reproductive tract, or less commonly, in the urinary tract
- unilateral involvement is the most common. There may be little palpable change in the SVs, or they can be enlarged, more firm, and may lose their lobulations. Pain may occasionally be exhibited when the glands are palpated. Real-time ultrasonography may be a useful in detecting fluid

accumulations, fibrotic changes, or calcification in affected glands. In rare severe cases, there may be signs of acute, local peritonitis.

- in the chronic form, the glands become firm and fibrotic and abscesses may form
- the semen may contain a white, flocculent precipitate of pus, or may be brownish tinged from blood pigments. A Wright-Giemsa or similar stain (e.g., Diff-Quik) should be used to detect the presence of high numbers of white blood cells (mainly neutrophils).
- the motility of the semen may be reduced but the effect of the disease on fertility is variable. The pH of the semen is often increased to > 7.0.
- culturing the semen for the causative organism is usually not satisfactory. Preferably, the culture sample should be taken after catheterizing the penis as aseptically as possible; this should include flushing the distal urethra with sterile saline prior to catheterization. Silastic tubing is often used as a catheter and is passed 15-50 cm into the urethra. The sample can then be collected by massaging the SVs and urethra transrectally while applying negative pressure (if needed) to the end of the catheter. Tranquilization of the bull will aid the extension of the penis necessary to carry out this procedure.

Treatment

- younger bulls will sometimes recover spontaneously. This might reflect a viral, mycoplasmal, or ureaplasma etiology that has not become secondarily infected with bacteria.
- in other bulls, the affected glands can become completely fibrotic after many months and may no longer affect the semen quality. If an abscess or other chronic nidus of infection develops, the condition may never improve.
- long-term antibacterial therapy (e.g., 14 days or more), using high dosages of antibiotics (that are preferably selected on the basis of sensitivity results), has been used with questionable success. In other species, trimethoprim-sulfa and erythromycin have been shown to achieve acceptable concentrations in the accessory sex glands when administered systemically. Enrofloxacin may also be useful; it is licenced for use in cattle against respiratory disease and is expensive. Tilmicosin (also licenced for use against respiratory disease) has apparently been successful in treating early cases if administered twice, 1-2 weeks apart. The aminoglycosides, penicillins, and tetracyclines tend not to achieve therapeutic levels in the accessory sex glands.
- non-steroidal anti-inflammatories, together with antibiotics, have been successful in improving the semen quality of some affected stud bulls so

that it could be successfully frozen. Therapy usually lasts for 10-14 days but may be required much longer because relapses are common.

- a procedure for surgical removal of the affected gland(s) through the ischioanal fossa is briefly described in Veterinary Obstetrics and Genital Diseases (Theriogenology) and Proc. Soc. for Therio., 1989, pp 137-139. This procedure is seldom used because an infected stump or other source of infection may continue to cause problems. Furthermore, excessive hemorrhage or damage to the ureters, ampullae, or innervation of the penis and bladder may result from the surgery. Semen quality has also been reported to decrease after vesiculectomy. In valuable 12-18 month-old bulls with uncomplicated seminal vesiculitis that is unresponsive to antibiotics, a ventral pararectal approach (ventral to the anus) has been more promising for seminal vesiculectomy. Laser therapy is also being tested. (See Proc. Soc. for Therio., 1993, pp 59-66 and pp 121-122, 2001, and J Amer Vet Med Assoc 205:596-599, 1994 for more information on these latter two techniques.)
- sometimes culling the affected bull is the most economical choice, especially for chronically affected older bulls.

b) Other species

- seminal vesiculitis has been reported to occur in the ram (caused by Brucella ovis - discussed later), and rather uncommonly in the stallion and boar. Clinical diagnosis of this condition in these species is more difficult than in the bull.
- affected stallions may exhibit hemospermia or pus in the semen. The occasional affected stallion may exhibit pain at breeding. The SVs of the stallion are sac-like structures that are difficult to palpate, but may be enlarged, more firm and possibly painful, if infected. Transrectal real-time ultrasonography often reveals seminal vesicles with thickened walls and cloudy luminal contents. Fractionation of the ejaculate using an open-ended artificial vagina may help differentiate infections of the testes, epididymides and ampullae (suggested by white blood cells in the sperm-rich fraction) from infections of the seminal vesicles or prostate (suggested by white blood cells in the latter portion of the ejaculate). A specific diagnosis of seminal vesiculitis may be aided by first teasing the stallion vigorously to distend the SVs. The stallion is sedated, if necessary, and a 100 cm long balloon-tipped catheter is passed as aseptically as possible up the urethra to the area just distal to the colliculus seminalis. The cuff is inflated and the SVs are individually and gently compressed. Separate catheters can be used if the material from the glands is to be collected separately. The material collected can be examined for its cytology and

submitted for culture and sensitivity. The causative organisms involved might include Pseudomonas, Klebsiella, Streptococcus, Staphylococcus, etc.

- if systemic antibiotic and other therapies are unsuccessful in treating this condition in a stallion, an open-ended artificial vagina may be useful to separate the sperm-rich fraction (which is chiefly in the first 3 jets) from the purulent fraction from the seminal vesicles (usually in jets 4-9). A treatment involving local antibiotic therapy using a catheter is described on p 15 of Current Therapy in Large Animal Theriogenology and in the reference given for under 'habronemiasis'. For more information on this condition in stallions refer to *Vet Clinics of N.A.: Equine Practice* 8:111-128, 1992.
- the use of artificial insemination and treating the semen with extender containing antibiotics as described under Klebsiella and Pseudomonas infections of the penis and prepuce might also be effective in certain breeding situations.

2) Conditions of the prostate gland

- these are most important in the dog where in addition to other symptoms, prostatic disease (especially prostatitis) may cause infertility due to fever, pain, decreased libido and/or mating ability, possible obstruction of the reproductive system, extension of infection to other portions of the reproductive tract, changes in the seminal fluid, etc.
- prostatic conditions of the dog will be discussed in another course. There is also a brief discussion of this topic in *A Manual for Theriogenology*.

Scrotum, Testicles, Epididymides, Vas Deferens and Spermatic Cord

1) Cryptorchidism ("ridglings")

- failure of the testicle to descend normally. The affected testicle may be subcutaneous (between the scrotum and inguinal ring), inguinal or abdominal. Occasionally, both testicles are involved.
- the affected testicle is small, soft, and produces testosterone but not spermatozoa
- most common in stallions, boars, and dogs
- possibly dominant inheritance with incomplete penetrance in stallions but probably recessive in the bull. In boars, the condition is thought to be inherited through two autosomal gene loci. In dogs, the mode of inheritance follows the model of an autosomal recessive trait but it could be polygenic. However, the exact mode of inheritance, including the number and penetrance of the genes involved is undefined. Indeed, precise genetic information is not available for most species.

- a final diagnosis of cryptorchidism in dogs and tomcats cannot be made until the inguinal rings close at 5-10 months of age. However, late testicular descent, especially at > 4 months of age, may not be normal and is certainly not desirable.
- in stallions, the descent of some inguinal (but not abdominal) testicles have been reported to occur spontaneously between 2 and 4 years of age but these individuals may not be normal
- without a reliable history, the stallion can present a diagnostic challenge when the descended testicle is removed prior to presentation or when the stallion is a bilateral cryptorchid. It then becomes the task of the veterinarian to determine whether s/he has been presented with a "studdy" gelding ("false rig") or a cryptorchid. Details on the hormonal tests used are presented in *A Manual for Theriogenology* and are required reading. These tests supplement palpation and the use of real-time ultrasonography (J Amer Vet Med Assoc 196:297-300, 1990) to find testicles in the scrotum, inguinal area or abdomen.
- a hormonal test for cryptorchidism in dogs using gonadotropin releasing hormone (GnRH) or human chorionic gonadotropin (hCG) stimulation is discussed in *A Manual for Theriogenology*.
- treatment consists of castration to reduce the chance of testicular tumors or torsion in dogs and reduce "studdy" behavior in stallions. The use of affected animals for breeding is not acceptable because of the probable heritability of the condition.
- the topic of cryptorchidism will also be discussed in other courses. For additional information on cryptorchidism refer to the appropriate reference textbooks, Proc. Soc. for Therio., 1991, pp 158-161 (stallions), Vet Clinics of N.A.: Small Animal Practice 21:533-544, 1991 (dogs), and other sources.
- monorchidism and anorchidism are rarely seen and must be differentiated from cryptorchidism.

2) Torsion of the spermatic cord (or "torsion of the testicle")

- much more common in cryptorchid testicles than in scrotal testicles in the dog. Occurs infrequently in stallions.
- causes acute pain. Dogs may exhibit emesis, stiffness of gait, and may even be presented in shock. Stallions often exhibit signs of colic. If a scrotal testicle is involved, there will be swelling of the scrotum.
- surgical removal of the affected testicle is often indicated unless an affected descended testicle is not severely damaged. In the latter case, the testicle may be straightened out and tacked down (orchiopexy) with a nonabsorbable suture at each end. Some suggest that orchiopexy be performed on the unaffected testicle at the time of surgery to prevent torsion

later on. There have been occasional reports of spontaneous resolution of this condition in the stallion.

- occasionally, a stallion might have one testicle located in the scrotum with a 180 degree rotation (i.e., with the tail of the epididymis pointing cranially). This is often a developmental abnormality and it does not appear to affect fertility. A similar condition has been occasionally found in the bull, but with rotation around the longitudinal axis rather than the transverse axis.

3) Testicular tumors

- most often reported in the stallion and dog. The risk of testicular tumors is much greater in the cryptorchid dog than in the normal dog. Older dogs are more commonly affected.
- in the dog, interstitial cell tumors, seminomas, and Sertoli cell tumors occur in descended testicles whereas tumors in cryptorchid testicles are usually Sertoli cell tumors or seminomas. Metastasis is most common with Sertoli cell tumors (10-20%), occurs occasionally with seminomas, and is rare with interstitial cell tumors. Ten percent to over one-third of testicular tumors have been reported to involve multiple tumors in one testis; usually an interstitial cell tumor occurs with a seminoma or Sertoli cell tumor.
- testicular enlargement (not common with interstitial cell tumors), abdominal enlargement (for cryptorchid testicles), signs of metastases, testicular torsion, and abnormal hormone production can all be presenting signs in dogs. Real-time ultrasonography (ref. - J Am Vet Med Assoc 198:1779-1784, 1991) or testicular biopsy may aid in the diagnosis; however, the tumor may be missed on biopsy. On ultrasonography, tumors > 5 cm diameter usually exhibit mixed echogenicity whereas smaller tumors are often hypoechoic or anechoic. The tumors are usually well circumscribed. Abdominal palpation, radiography, and ultrasonography may be useful in the diagnosis if the testicle is cryptorchid. Twenty-five to 50% of dogs with Sertoli cell tumors (and perhaps the occasional dog with seminoma) show signs of hyperestrogenism. These include feminization (atrophy of the penis and contralateral testis, reduced libido, attraction of males, gynecomastia, pendulous prepuce), dermatologic disorders (alopecia, atrophy, increased cutaneous pigment, and sometimes pruritis), prostatic enlargement (squamous metaplasia and/or cysts), and myelotoxicosis (anemia, thrombocytopenia, leukopenia). Therapy for testicular tumors in dogs includes orchiectomy, medical therapy if myelotoxicosis exists, and surgical and medical therapy if there is metastasis.

- seminomas are reported to be the most common testicular neoplasm in stallions, although teratomas are probably the most common tumor in the retained testicle of cryptorchids or in younger stallions. Seminomas may metastasize and therefore it is prudent to remove any testicle that is > 12-15 cm in diameter. As much of the spermatic cord as possible should be removed. Biopsy of large testicles may cause tumor dissemination. Real-time ultrasonography may aid in the diagnosis of this condition (areas of decreased echogenicity may be seen) but tumors are not always detectable by ultrasonography or palpation. Transrectal exploration of the iliac lymph nodes may reveal if metastasis has occurred. Teratocarcinomas, embryonal carcinomas, lipomas and interstitial cell tumors have also been reported in stallions, but Sertoli cell tumors are very rare. Stallions with interstitial cell tumors can sometimes exhibit behavioral changes, e.g., viciousness and aggression.
- 5-10% of bulls over 7-years-old can have small interstitial cell tumors that are not clinically evident. These tumors could possibly suppress spermatogenesis by producing sex steroids or causing pressure.
- testicular tumors and their effects are discussed in more detail in the appropriate reference textbooks and will also be discussed in other courses.

4) Lesions of the scrotum

a) Conditions affecting the skin

- frostbite (most common in ruminants), dermatitis, chorioptic mange (especially in rams), scrotal edema (e.g., often accompanied by hydrocele in the occasional stallion in summer, eperythrozoon infection in bulls), scrotal abscesses (in rams, from shearing accidents, etc.), and excessive wool cover in rams can all result in elevated testicular temperatures and therefore interfere with spermatogenesis
- depending on the severity of the lesion, normal sperm output might not return until up to 2 months or more after the condition has cleared. In severe cases, normal sperm production may never return.
- treatment varies with the etiology of the lesion, e.g., insecticides for mange; exercise, hydrotherapy, diuretics and possibly anti-inflammatories for scrotal edema; tetracyclines vs eperythrozoon infection; local therapy and quarantine for scrotal abscesses.

b) Abnormal shape

- most common in bulls

- can adversely affect spermatogenesis if the testicles are suspended too close to the body resulting in interference with the thermoregulatory mechanism.

c) Hemangioma

- benign, scrotal hemangioma that occurs in boars in certain countries but surprisingly doesn't usually affect fertility.

d) Inguinal hernia

- refer to your surgery notes.

5) Varicoceles

- dilation and increased tortuosity of the veins of the spermatic cord (i.e., pampiniform plexus) that is occasionally palpated in the scrotums of rams, stallions, bulls and dogs. The affected spermatic cord is enlarged and may have the texture of a "bag of worms".
- the effects on fertility can vary from none to moderate, depending on the degree of interference with thermoregulation.

6) Hematocele and hydrocele

- accumulation of blood or fluid between the vaginal tunics. Real-time ultrasonography is useful in establishing the diagnosis.
- hematocele usually results from trauma and hydrocele usually results from **periorchitis** or (especially in stallions) impaired circulation of the lymphatics or blood vessels in the mesorchium, or occasionally, ascites. Lack of exercise alone may cause this condition in stallions, especially in summer. Hematocele and hydrocele can be differentiated by aseptic centesis.
- both conditions can result in damage to spermatogenesis and/or adhesions of the vaginal tunics
- conservative therapy includes hydrotherapy, systemic antibiotics, diuretics, non-steroidal anti-inflammatories, rest from sexual activity, etc. Recovery has been reported to take up to 120 days in bulls that respond to conservative therapy. Obviously, increasing exercise can alleviate the condition in stallions when lack of exercise is the cause.
- aseptic removal of blood (before extensive clotting) by aspiration or even surgery may be an effective treatment for hematocele; however, this therapy is untested
- in unilateral cases, careful and aseptic unilateral orchiectomy is indicated when conservative therapy fails. This procedure is necessary so that the unaffected testicle will not be severely or permanently compromised by the

increased scrotal temperature. If this procedure is successful, the remaining testicle appears to compensate by eventual hypertrophy and increasing sperm production up to 80% of previous production from both testicles.

- if the condition is bilateral and severe or irreversible, bilateral orchiectomy may be indicated.

7) Orchitis and epididymitis

- may occur separately or together

Etiology

- can result from trauma, penetrating wounds, etc. and possible extension from other parts of the tract
- infectious causes that generally result from systemic infections or hematogenous spread include: Brucella abortus and the Strain 19 vaccine (in bulls, in areas where the disease exists), Brucella suis (in boars, but seldom seen in North America, especially Canada), Brucella ovis (epididymitis in rams), Brucella melitensis (in goats, but seldom seen in North America), Brucella canis (in dogs), Streptococcus (especially in stallions), Salmonella abortus equi (in stallions), Actinobacillus spp. and Haemophilus/Histophilus (epididymitis in rams, etc.), and the "epivag" virus (epididymitis in bulls in Africa). Arcanobacterium pyogenes, Staphylococcus, Proteus, E. coli, Pseudomonas, Pasteurella/Mannheimia, Chlamydia/Chlamydia, mycoplasmas, ureaplasmas (?), and various viruses and other bacteria could also be involved in orchitis or epididymitis. Canine distemper virus, blastomycosis and Pseudallescheria boydii are possible additional etiologies in dogs. A localized epididymitis from the migration of Strongylus edentatus larvae is possible in horses.

Pathogenesis and diagnosis

- orchitis results in increased testicular temperature as well as inflammation of testicular tissue. In cases of unilateral orchitis, the increased temperature in the affected testicle can cause degeneration of the adjacent testicle as well. The tunic tends to restrict swelling and pressure is therefore built up on the seminiferous tissue. The condition can be quite painful. Abscesses may form.
- epididymitis interferes with sperm transport and storage. The tail of the epididymis is most frequently involved. Proximal involvement, especially of the efferent ducts, may result in the failure of fluid absorption in the epididymis and back pressure on the testis, resulting in rapid damage to the testicle. The affected portion of the epididymis usually feels firm and

enlarged and is occasionally painful. Spermatic granulomas can result from rupture of the epididymal tubule and the escape of spermatozoa into the surrounding tissues. In severe cases, epididymitis will also increase the scrotal temperature.

- in both epididymitis and orchitis there can be a variable reduction in sperm cell concentration and white blood cells may be present in the ejaculate. There is usually decreased sperm cell motility and an increased number of abnormal cells. Immobilization or head-to-head agglutination of sperm cells may occur due to antisperm antibodies produced by the breakdown of the blood-testis barrier. Semen culture, fine-needle aspiration of the epididymis, or possibly urine culture (epididymal secretions are normally transported from the vas deferens to the bladder in the absence of ejaculation) can be used to isolate the causative organism. Real-time ultrasonography might be useful to characterize the lesion(s).

Treatment

- rest from sexual activity
- prolonged therapy with high levels of antibiotics
- hydrotherapy, non-steroidal anti-inflammatories, etc.
- corticosteroids may be indicated when there is evidence of antisperm antibodies being produced. However, antibiotics must be able to control any infection in the presence of these drugs.
- unilateral orchiectomy may be indicated in order to save the unaffected testicle if the condition is unilateral. Bilateral orchiectomy may be indicated if the both testicles are involved and the condition becomes severe or irreversible.
- cull Brucella infected animals. Pet dogs with brucellosis can be castrated and antibiotic therapy attempted (refer to *A Manual for Theriogenology*).
- epididymitis in rams is discussed in more detail in the next section.

8) Epididymitis in rams

a) Brucellosis

- caused by Brucella ovis. The disease is relatively common in western North America.
- transmission is by the venereal route between rams and ewes, homosexual activity between rams, or by the oral route. Homosexual activity is responsible for most of the carry-over of the disease from one year to the next because the ewe generally does not spread the disease for more than 1-2 heat cycles. Congenital infections may occur as well and if lesions develop in these offspring, they generally do so after they reach puberty.
- the disease is usually seen in multiple-sire systems
- there are many subclinical carriers and shedders. Transient infections have also been reported where rams develop serological titres but the infection doesn't become established and they don't shed the bacteria in the semen; these infections may not be important in eradication programs. In active infections, the lesions (usually involving the tail of the epididymis) develop within 6-7 weeks and often result in the formation of spermatic granulomas. As the condition progresses, testicular degeneration may occur. Eventually, lesions can often be palpated in any portion of the epididymis and if the infection is bilateral, the ram will be sterile. The semen quality will vary with the stage and severity of the disease but usually reflects the changes described in the preceding section. Sperm cell defects include abnormal tails and detached heads. Seminal vesiculitis may occur and the organism may also localize in the kidney, ampullae, and/or the bulbourethral glands. Decreased fertility in infected ewes, embryonic death, abortions, stillbirths, and weak lambs have also been reported.

Diagnosis

- clinical and pathological signs. However, palpation only identifies 15-20% of B. ovis infected rams.
- culture of the semen and/or examination of semen smears stained with the modified Ziehl-Neelsen technique to detect the acid-fast organisms. Multiple semen cultures may be necessary to establish a diagnosis, because the method is not that reliable. It has been recommended to freeze the semen for transporting it to the laboratory for culture.
- a serum complement fixation (CF) test has been useful in the past, but a serum ELISA (enzyme-linked immunosorbent assay) test that has been developed recently is more reliable. A ram or flock that tests negative on two consecutive ELISA tests 30-45 days apart is generally free of the

disease provided infection did not occur during the testing period. Approximately 10% of nonvaccinated rams that are ELISA positive for B. ovis may turn negative in 60-90 days. However, an estimated 3.5% of infected rams can be negative on serological tests but can shed the organisms for long periods of time.

- rams with > 3-4 white blood cells per high power field on a Wright-Giemsa or Diff-Quik stained semen smear have a 60-80% chance of being infected.
- culture of the epididymides, seminal vesicles, etc. on postmortem specimens.

Treatment

- treatment is generally ineffective and not advisable. Prolonged treatment with tetracyclines and dihydrostreptomycin may be attempted for valuable rams without palpable abnormalities of the epididymides. However, there is a risk to the flock if the treatment is not effective. Treated rams should only be used in single-sire mating groups in order to prevent possible spread to other rams.

Control

- cull infected rams
- the vaccine is not highly efficacious and will not prevent or eliminate infection; it also interferes with serological testing and is therefore not recommended
- eradication schemes have been recommended for flocks based on the ELISA test, clinical evaluation of the reproductive tract, and culling affected rams. It is best to test the rams and eliminate the infected ones when sexual activity is at its lowest. All rams are tested (using the ELISA test) at ≥ 6 months of age; the positive and suspect rams are removed and the remainder are retested every 30-45 days until two negative flock tests are achieved. After this, testing should be repeated after each breeding season, and possibly before. Replacement rams must be negative for B. ovis on the ELISA test and should preferably be virgins. All rams should be tested prior to purchase, isolated, and retested in 30-45 days. It has also been suggested that the semen of all the rams be cultured periodically to confirm their B. ovis negative status.
- farmers should be discouraged from lending out their rams.
- refer to Proc. Soc. for Therio., 1991, pp 288-291 and The Compendium on Continuing Education for the Practicing Veterinarian 17:447-454, 1995 for further information on this disease.

b) Lamb epididymitis organisms (LEO's)

- Actinobacillus seminis, Actinobacillus actinomycetemcomitans, and Haemophilus somnus (= Histophilus ovis) can infect the reproductive tracts predominantly in 4-18 month old rams with the highest incidence occurring at 6-12 months of age
- may be transmitted by homosexual activity between rams, but this is in doubt. Some have suggested association with high energy rations, overcrowding, and unhygienic conditions.
- the causative organisms probably colonize the reproductive tract during the period of hormonal increases associated with normal maturation and puberty. Most individuals clear the infection spontaneously but some develop subclinical or clinical disease. Subclinically infected rams will have the organisms in the semen and possibly urine and will have an increase in white blood cells in the semen. Acute clinical disease, usually involving orchitis and epididymitis, may occasionally be seen. Chronic clinical epididymitis probably follows some period of subclinical infection.

Diagnosis

- clinical and pathological signs, the appearance of white blood cells in the semen, and culture of the semen, epididymides and testicles. One should rule out the presence of B. ovis infection based on the age and history of the affected rams, and B. ovis culture and serology.

Treatment and control

- subclinical infections may clear spontaneously in 4-6 weeks or they can be treated with long-acting injectable tetracyclines every 3 days for at least 3 treatments. The semen should be evaluated at the end of 20-30 days to evaluate the effectiveness of treatment.
- clinically affected animals should be culled because treatment is usually futile. However, there is a small chance that the disease may respond to tetracyclines if therapy is started before permanent fibrosis has occurred.
- the incorporation of antibacterials into the ration (e.g., 100 mg sulfamethazine and/or 150-250 mg tetracycline/ram/day for 4-6 months) may reduce the incidence of the disease
- autogenous vaccines or even the Haemophilus somnus vaccine for cattle may be of benefit. A commercial vaccine may become available in the future.
- refer to Proc. Soc. for Therio., 1991, pp 283-287 for further information on this disease.

c) Epididymitis from organisms other than those described in a and b

- can occur sporadically

- refer to section 7

9) Segmental aplasia of the Wolffian duct

- not common
- probably inherited, e.g., recessive in the bull
- can result in missing portions of the vas deferens (including the ampulla) or epididymis, and can be accompanied by **aplasia or hypoplasia of the seminal vesicle** on the affected side. Aplasia or (especially) hypoplasia of the seminal vesicles may occasionally occur by themselves.
- results in the lack of sperm transport on the affected side if the vas deferens or epididymis are involved
- in the epididymis, a spermatocele or spermatic granuloma may form proximally to the lesion. (See the next section.)

10) Spermatoceles and spermatic granulomas from congenital lesions of the epididymides

- occur most often in polled bucks but have been reported in horned bucks, rams, bulls, stallions, and boars
- is often the result of efferent ducts that end blindly and is therefore more common in the area of the head of the epididymis. A distension or spermatocele forms proximally to the lesion and a spermatic granuloma results when sperm cells escape into the surrounding tissues. Trauma is also a possible cause.
- infertility can develop if the granuloma obstructs the passage of sperm. Testicular degeneration can occur if there is back pressure created by testicular fluids, especially if the lesion is proximal.
- can be mistaken for epididymitis.

11) Sperm occluded ampullae in the stallion

- oligospermia or azoospermia are observed. If there are spermatozoa in the ejaculate, there is usually a low percentage of morphologically normal sperm with a high percentage of tailless heads and low sperm motility.
- the affected ampullae may have increased tone or distension and elongation. Real-time ultrasonography often reveals distended lumens with echolucent contents, sometimes containing hyperechogenic debris (inspissated sperm). Affected stallions usually have prominent epididymal tails. Alkaline phosphatase (AP) levels in the seminal plasma will be low because AP originates from the epididymides (refer to discussion under 'Breeding Soundness Evaluation of Stallions' in *A Manual for Theriogenology* if you want details.)

- treatment can include massage of the affected ampullae for at least 5 minutes before each semen collection (be careful not to damage the rectal wall) until the blockage is removed and inspissated sperm and secretions are released from the lumen and glandular crypts. Twenty units of oxytocin IV, or prostaglandins IM or SC just before collection may also help but there may be a risk of rupture of the ampulla if it is completely blocked. Affected stallions must be collected frequently [e.g., ≥ 4 times daily, if libido is sufficient (or at least 2 times daily) for 1-2 weeks and then at least 3 times weekly, possibly year round].
- ref. - Proc. Soc. For Therio., 1992, pp 117-127.

12) Testicular hypoplasia

- important cause of infertility in males
- often bilateral but can be unilateral.
- genetic in origin, e.g., recessive autosomal with incomplete penetrance in the bull. Testicular hypoplasia and testicles that are held close to the body are relatively common in bulls with muscular hypertrophy ("double muscling"). Animals with testicular hypoplasia are predisposed to testicular degeneration.
- hypoplastic testicles are obviously smaller than normal and this can vary in severity. Hypoplastic testicles can be of normal consistency but if degeneration occurs, they may be soft, and chronic or severe cases may be firm and fibrotic..
- the semen sample can be normal but affected testicles have a reduced capacity to produce sperm. If degeneration occurs, the quality of the sample will be poor, as described under that condition.
- livestock positively diagnosed to have testicular hypoplasia should be culled.

13) Testicular degeneration

- important cause of infertility in males and is usually bilateral
- can sometimes be difficult to differentiate from testicular hypoplasia by clinical examination, but this may be possible histologically and a good history may help
- testicular degeneration can be caused by some of the lesions of the testes, epididymides, and scrotum that have already been discussed. Chronic elevation of the scrotal temperature by high environmental temperatures, fever, or any other cause can also be included. Other causes include vascular lesions (e.g., from biopsies or from strongyle or viral infections in stallions), trauma, nerve damage, stress, chronic disease, poor nutrition

(undernutrition can also decrease testicular size and function), overconditioning in beef bulls, various toxins and drugs (e.g., gossypol from cottonseed, griseofulvin and amphotericin B), autoimmune diseases, gonadotrophin deficiencies (including those that result from the administration of anabolic steroids to animal athletes), old age, irradiation, etc. Often the cause of testicular degeneration is idiopathic and not diagnosed, and sometimes seems to occur for no apparent reason. The causes of testicular degeneration for the various species are discussed in more detail in *A Manual for Theriogenology*. The sections on testicular degeneration (and hypoplasia) in the appropriate reference textbooks are sources of additional information.

- may exhibit soft testicles that may decrease in size. Chronic or severe cases may be firm and fibrotic.
- the semen sample can have a low concentration of sperm cells and motility may be poor. There are usually high numbers of sperm cell defects, including head defects and proximal droplets. If degeneration is severe enough, cells from the germinal epithelium and possibly, multinucleated cells may occasionally appear in the semen. These cells must be differentiated from white blood cells using the Wright-Giemsa or Diff-Quik stains. Leukocytes tend to be fairly uniform in size and may clump if in high enough numbers, whereas the size of germinal cells can be variable.
- testicular degeneration or dysfunction can result in increased serum FSH (follicle stimulating hormone), and possibly LH (luteinizing hormone), levels in men, stallions and dogs (and probably other species as well). Samples for these hormones should be taken at the same time each day for at least 3 consecutive days. Stallions with these conditions may also have decreased levels of serum estrogens.
- the inciting cause of testicular degeneration should be removed or treated, if it is known. If the animal is to recover, it could take up to two months or more. There is anecdotal evidence that administering 0.5 µg/kg gonadotropin-releasing hormone (GnRH) IM every 2-3 days for 2-3 weeks might be beneficial for the treatment of dogs with this condition.

14) Testicular aplasia

- seems to be rare in domestic animals
- in general, male animals that are presented with one or more testicles missing from the scrotum should be considered cryptorchids or castrates until proven differently.

15) Tortoise-shell, tri-colour, or calico cats

- the black and orange coat colours are linked to X genes, and in order to have both these colours, two X genes must be present
- tomcats that have both these colours are therefore XXY (similar to Klinefelter's syndrome in humans) or mosaic (e.g., XX/XY, XY/XXY) individuals and are usually sterile or infertile
- **chromosomal abnormalities** of various types can result in sterility or infertility in all species.

Behavioral Problems

- these have been included in *A Manual for Theriogenology* the following headings:
 - Stallions - Behavioral problems and urination during ejaculation (required reading)
 - Dogs - Undesirable mounting and masturbation
 - Tomcats - Urine spraying.

Low libido

- physical causes - pain, obesity, debilitation, age, heat stress, etc.
- managemental causes - lack of experience with females, poor breeding management, etc.
- libido is probably heritable to some degree in most species
- homosexuality has been reported in rams
- if physical or managemental causes can be ruled out, one should consider not using low libido males for breeding
- testosterone may be effective in stimulating libido but is detrimental to spermatogenesis
- luteinizing hormone (LH) preparations (e.g., hCG) and prostaglandins have been used to try and stimulate libido in valuable males.

(Revised February 2005 - GFR)