Management of common surgical problems of the bull genitalia

Dwight F. Wolfe
Food Animal Section, Department of Clinical Sciences, College of Veterinary Medicine, Auburn University, Auburn, AL

Abstract

Numerous congenital or acquired defects of the bull genitalia prevent normal breeding efficiency. This presentation will review the anatomy and pathophysiology of congenital defects and acquired conditions of the penis and prepuce of bulls that compromise reproductive soundness and that are amenable to surgical repair. Medical and surgical options for returning bulls to breeding soundness will be discussed.

Keywords: Bull, penis, prepuce, injury

Introduction

Diagnosis and management of defects or injuries of the bull penis and prepuce requires good understanding of the normal anatomy as well as the physiology of erection and coitus. The non-erect penis of the bull is contained within the sheath which is a double invagination of skin along the ventral abdominal wall. The skin of the sheath is covered with hair and terminates distally at the preputial orifice where it joins the non-haired epithelium of the prepuce.[1] The prepuce terminates at the free portion of the penis several centimeters proximal to the glans penis at the preputial ring.[2]

The diameter and length of the prepuce varies considerably among bulls of varying breeds and ages but the prepuce of an adult bull is 35 to 40 cm long and approximately 4 cm in diameter. The prepuce of *Bos indicus* breeds averages 5.5 cm longer than bulls of the *Bos taurus* breeds and they have a more pendulous sheath and larger preputial orifice which is 2 to 4 cm in diameter in *Bos taurus* breeds may exceed 10 cm in some *Bos indicus* bulls.[3]

Multiple interdigitating layers of elastic tissue between the preputial epithelium and the tunica albuginea of the penis allow the penis to glide within the sheath from full retraction to full extension. There is wide variation among bulls such that the penis extends 25 to 60 cm beyond the preputial orifice during full erection therefore full excursion of the glans penis may be greater than 1 meter.[3,4]

Penile and preputial conditions of young bulls

The most common anomalies of the penis, prepuce, or sheath of young bulls that prevent breeding soundness are penile fibropapillomas, persistent frenulum, and incomplete separation of the penis and prepuce.

Penile fibropapillomas

Fibropapilloma or warts caused by bovine papilloma virus are fairly common in young bulls reared in groups. The virus is believed to enter the penile skin through wounds or abrasion sustained during homosexual activity among young bulls and causes neoplastic growth of fibroblasts which is not locally invasive or metastatic. Often several bulls in a group will develop penile fibropapillomas and affected bulls frequently do not have obvious lesions on other parts of the body.[5,6]

Penile fibropapillomas are usually easily removed with the bull restrained on a tilt table or in a squeeze chute. Manually extend the penis and following antiseptic preparation of the surgical field infiltrate 2 to 4 ml 2% lidocaine hydrochloride subcutaneously across the dorsum of the penis proximal to the lesion for regional anesthesia of the surgical site. Carefully identify the urethra to avoid incising this tissue during excision of the growth. Dissect the skin of the penis at the base of the lesion until the growth is completely removed with either sharp dissection with a scalpel or with a CO_2 laser to assist hemorrhage control. Ligate any small vessels and close the skin defect with #0 absorbable suture. Bulls treated for penile fibropapilloma should have enforced sexual rest and be examined for healing or regrowth four weeks following surgery before entering breeding service.[7]

Persistent frenulum, and incomplete separation of the penis and prepuce

As young bulls complete puberty the penis grows in length and diameter and a sigmoid flexure develops. The surface epithelium of the free portion of the penis is firmly attached to the epithelium of the prepuce at birth and these interdigitating tissues begin to separate at approximately four weeks of age and proceeds caudally until complete separation occurs between wight and 11 months of age. The separation rarely occurs prematurely in young bulls, perhaps caused by juvenile attempts at mounting and penile extension, resulting in hematoma formation from hemorrhage of the surface epithelial layers. Affected bulls may have swelling along the distal sheath with evidence of hemorrhage on the preputial hairs. Following sexual rest complete recovery may be expected unless excessive fibrosis develops between the surface epithelial layers which may permanently prevent penile extension.[7]

More commonly incomplete separation of the penis and prepuce which prevents complete penile extension is seen in bulls over 11 months of age. Manual traction of the free portion of the penis and prepuce may complete the separation but should be avoided if the tissues are tightly adhered such that tearing or hemorrhage will be created. This condition is thought to be associated with later maturity and perhaps may have an undesirable heritable component.

During normal separation of the epithelium of the penis and prepuce of young bulls the frenulum, a thin band of collagenous connective tissue on the ventral midline that extends over the basal 80% of the free end of the penis, ruptures allowing complete separation of the glans penis and prepuce. When this band of tissue fails to rupture the penis can extend but the persistent frenulum impairs straightening of the tip of the penis and may prevent intromission.[8,9] The persistent frenulum is easily diagnosed as a band of tissue from the median raphe at the posterior of the glans penis to the prepuce. This epithelium covered band may be thin or broad and usually contains one or more blood vessels. Persistent frenulum is easily surgically repaired by ligating each end of the frenulum and transecting the tissue to reduce the possibility of hemorrhage. Although controversial, the owner should be advised that this condition is considered to be heritable and retaining his sons as sires is not recommended.[9]

Breeding injuries

The most common breeding injuries that prevent reproductive soundness are preputial lacerations. Bulls with preputial injury may prolapse the preputial epithelium distal to the end of the sheath or develop phimosis wherein the bull is unable to freely extend the penis and prepuce through the end of the sheath. The extent of damage of the surface epithelium and underlying peripenile elastic tissue determines the prognosis and therapeutic approach for returning the bull to breeding soundness.

Primary preputial prolapse in the bull is usually the sequela to bruising or contusions during breeding or to frostbite or balanoposthitis caused by herpes viral infection (IBR-IPV). Secondary preputial prolapse may occur with penile hematoma or urethral rupture. Bulls with preputial frostbite may undergo considerable necrosis of the preputial epithelium and heal with mild to severe stenosis of the preputial lumen causing phimosis.[10,11]

Due to their pendulous sheath and longer prepuce *Bos indicus* breeds and their crosses more commonly develop preputial prolapse following preputial laceration. During intromission the prepuce is abruptly forced caudally forming a collar of taut tissue at the preputial orifice which may become forcefully entrapped between the bull's abdomen and the vulva and pelvis of the cow during the ejaculatory lunge. The subsequent contusion and occasionally laceration or bursting of the skin on the longitudinal axis of the ventral aspect of the prepuce leads to edema which quickly develops in the traumatized skin and underlying elastic tissue leading to prolapse of the prepuce. As the penis is withdrawn into the preputial cavity the longitudinal tear of the surface epithelium assumes a transverse orientation which effectively shortens the ventral aspect of the prepuce and in *Bos indicus* breeds may not be fully retracted into the preputial cavity. As edema accumulates in the damaged tissues the prolapsed prepuce increases in size and the laceration is evident as a transverse wound on the caudal aspect of the prolapsed tissues. The edematous prolapsed prepuce frequently sustains additional trauma with subsequent extreme mutilation, cellulitis, necrosis, fibrosis and risk of frostbite in colder climates.[10,12]

Laceration of the prepuce of *Bos taurus* breeds usually does not lead to preputial prolapse as the damaged prepuce is typically withdrawn into the sheath where swelling of the sheath may be observable. Minor injuries are often unnoticed and heal without complication with only superficial scarring visible on the surface epithelium of the prepuce.[10-12] Alternatively some *Bos taurus* bulls develop paraphimosis wherein the damaged tissues will not allow retraction of the penis into the sheath. Often bulls with moderate to severe laceration retract the penis into the sheath and develop phimosis due to stricture of the injured prepuce.

The most critical factors for determining the return to breeding soundness are the length of the preputial skin that is disrupted and the extent of damage to the peripenile elastic tissue. In order to allow sufficient penile and preputial extension for breeding the remaining prepuce must be at least 1.5 times the length of the free portion of the penis following surgical repair. The peripenile elastic tissue must also be sufficiently free of scar tissue to allow complete extension and retraction of the penis and prepuce.[11]

Medical management of preputial prolapse

The prolapsed tissues should be cleaned with antiseptic scrub and an emollient antiseptic ointment applied. Frequently this symptomatic treatment allows bulls with a minor laceration and prolapse to resume breeding soundness following at least 60 days sexual rest.[10-12] For bulls with more extensive tissue damage and edema that prevents returning the prepuce into the preputial cavity compression bandaging or other support is indicated. Change the bandage every second or third day or sooner if it becomes loose or extremely soiled. Bulls with preputial laceration and prolapse may sustain considerable and possibly deep necrosis and slough of preputial skin and elastic tissues after the first few bandage changes. These healing tissues should be covered by healthy granulation tissue before reversion into the preputial cavity or surgery is considered.

When the initial edema subsides in bulls with mild to moderate preputial prolapse the prepuce should be reverted into the preputial cavity and held in place by elastic bandaging with a urinary drainage tube incorporated into the bandage. Placing a purse-string suture in the preputial orifice should be avoided due to the risk of abscess formation and subsequent stenosis of the preputial orifice.

Because they do not usually prolapse the prepuce after injury bulls of *Bos taurus* breeds are more likely to develop phlegmon within the sheath or retropreputial abscess. These bulls have a guarded prognosis for returning to breeding soundness and systemic antibiotics, irrigation of the preputial cavity with mild antiseptic solutions and hydrotherapy may reduce the risk of severe complications. Following a minimum of 60 days of forced sexual rest evaluate the prepuce for scar formation that restricts penile extension prior to resuming breeding. Phimosis or impaired extension is very likely since the original longitudinal wound healed transversely and may be associated with significant fibrosis of the elastic tissues.

Surgical management of preputial injury

Circumcision. Resection and anastomosis of the prepuce, frequently called circumcision, provides the best prognosis for return to breeding soundness when scar tissue in the prepuce prevents normal penile extension and coitus. Circumcision requires full extension of the penis and prepuce which may require incision of fibrous stenotic areas of the prepuce. The guideline for the maximum amount of prepuce that may be removed is that the remaining prepuce must be at least one and one-half times the length of the free portion of the penis. Repeat of the prolapse is likely when the bull resumes breeding if the prepuce is left excessively long. Alternatively, if the prepuce is shortened excessively the bull will be unable to completely extend the penis.

Following aseptic preparation of the surgical field apply a 2.5 cm Penrose drain around the penis and prepuce at the preputial orifice as a tourniquet and make circumferential incisions through the preputial epithelium proximal and distal to the area to be removed. With a scalpel or CO_2 laser make a longitudinal incision through the epithelium to join the circumferential incisions. Remove the skin of the injured area by blunt and sharp dissection taking care to only remove fibrotic tissues.

Ligate or seal all visible elastic tissue vessels by judicious electrocautery then remove the tourniquet and ligate any remaining vessels to ensure complete hemostasis. Appose the subcutaneous elastic tissue with #0 chromic gut in a simple interrupted pattern or in a simple continuous pattern tied at each quadrant of the circumference of the prepuce. Close the skin of the prepuce in similar fashion ensuring end-to-end apposition of the skin edges and place a 2.5-cm Penrose drain over the free portion of the penis to provide urine drainage away from the surgical site. Secure the Penrose with 3 or 4 absorbable sutures through the latex tubing and the skin of the penis. Revert the penis and prepuce into the preputial cavity and place a semi-flexible rubber tube of maximum diameter into the lumen of the prepuce and firmly wrap the distal portion of the haired sheath with elastic tape to serve as a pressure bandage on the incision. Remove the pressure bandage and rubber tubing three to fice days postoperatively and leave the Penrose drain on the penis until skin sutures are removed in ten days. Ensure a minimum of 60 days sexual rest and evaluate the bull prior to resuming breeding.[11-13]

Preputial reconstruction by scar revision. For bulls with insufficient prepuce to allow resection and anastomosis the bull may be returned to breeding soundness with scar revision and preputial reconstruction. With the prepuce prepared for aseptic surgery extend the penis and excise only the superficial transverse scar tissue. Return the edges of the preputial incision back to their original longitudinal orientation and loosely place an absorbable bootlace suture in a longitudinal plane such that the free ends are toward the sheath. Suture a 2.5-cm Penrose drain over the free potion of the penis and revert the penis into the preputial cavity. Tighten the previously placed preputial sutures to appose the skin edges. The goal of this procedure is to allow the surgical wound to heal in a longitudinal plane and to maintain normal elastic tissue function. Since no elastic tissue or preputial skin is removed first intention healing should reduce the risk of preputial stenosis and allow subsequent penile extension. Many bulls begin to masturbate a few weeks following surgery and will stretch contracted tissues without permanent damage. Most bulls require 60 to 120 days to regain full penile extension and forceful attempts to extend the penis should be avoided as the potential trauma increases the likelihood of excessive scar formation.[11]

Inability to extend the penis (phimosis)

The most common cause of phimosis, the inability to extend the penis, in adult bulls is preputial stenosis resulting from scar tissue. The stenosis is most often a sequelae of either breeding injury laceration or frostbite. Either case may be corrected surgically by circumcision if removal of the damaged tissues leaves sufficient healthy prepuce and elastic tissue for normal penile extension.

The most limiting factors for the likelihood of returning to breeding soundness for a bull with preputial laceration are the extent of the damage to the peripenile elastic tissue and the length of preputial skin that is lacerated. After reconstructive surgery the remaining prepuce must be at least 1.5 times as long as the free portion of the penis in order for full penile extension.[11,12]

References

1. Ashdown R: Functional anatomy of the penis in ruminants. Vet Anat 1973;14:22-25.
2. Ashdown R, Rickets, Wardley R: The fibrous architecture of the integumentary coverings of the bovine penis. J Anat 1968:103;576-578.
3. Bellinger CR: A comparison of certain parameters of the penis and prepuce in various breeds of beef cattle. Res Vet Sci 1971;299-304.
4. Ashdown R, Pearson H: Anatomical and experimental studies on eversion of the sheath and protrusion of the penis in the bull. Res Vet Sci 1973;15:13-24.
5. McEntee K: Fibropapilloma of the external genitalia of cattle. Cornell Vet 1950;40:304-312.
6. Olson C, Robl MG, Larson LL: Cutaneous and penile bovine fibropappilomatosis and its control. J Am Vet Med Assoc 1968;153:1189-1104.
7. Wolfe DF, Rodning SP: Diagnosis and management of juvenile anomalies of the penis and prepuce. In: Anderson DE, Rings M, editors. Current veterinary therapy, food animal practice. 5th ed. St. Louis: SaundersElsevier; 2009. p.340-341.
8. Ashdown R, Pearson H: The functional significance of the dorsal apical ligament of the bovine penis. Res Vet Sci 1971;12:183-184.
9. Carroll EJ, Aanes WA, Ball L: Persistent penile frenulum in bulls. J Am Vet Med Assoc. 1964;144:747-749.

10. Wolfe DF, Hudson RS, Walker DF: Common penile and preputial problems in bulls. Compend Contin Educ Pract Vet 1983;447-455.
11. Wolfe DF, Beckett SD, Carson RL: Acquired conditions of the penis and prepuce. Large animal urogenital surgery. Baltimore: Williams and Wilkins, 1998; p. 237-272.
12. Memon M, Dawson L, Usenik E, et al: Preputial injuries in bulls. J Am Vet Med Assoc 1988;193;484-485.
13. Cardwell W: The surgical correction of preputial and penile disorders o the bull. Southwestern Vet 1961;Summer:270-273.