Erection failure as a sequela to obstructive urolithiasis in a male goat

Paddy Todhunter, BVSc, MS; A. N. Baird, DVM, MS; Dwight F. Wolfe, DVM, MS

- Celiotomy followed by insertion of a Foley catheter into the urinary bladder is an effective surgical treatment of obstructive urolithiasis in small ruminants.
- Contrast radiography of the corpus cavernosum penis is valuable in the diagnosis of erection failure.
- Vascular occlusion of the corpus cavernosum penis, and subsequent erection failure, may develop secondary to obstructive urolithiasis in bucks.

A 14-month-old 40-kg Anglo-Nubian buck was referred to the large animal clinic for erection failure of 3 months' duration. Six months before referral, the client's veterinarian had successfully treated the buck for obstructive urolithiasis by amputating the urethral process. Three months later, the buck was initially referred for recurrent obstructive urolithiasis. At that time, an exploratory celiotomy was performed and an indwelling Foley catheter was inserted into the urinary bladder. The catheter provided a diversion for urine flow, which allowed time for urethritis to subside, and urinary calculi to dissolve and pass, in response to medical management.[1] A penile urethrotomy was avoided because the buck was intended for breeding purposes and a high prevalence of stricture formation and reobstruction has been reported following this surgery.[2,3] A ruptured urethra was suspected but was not confirmed by contrast radiography. Urination was normal at the time of discharge from the hospital 16 days after surgery. To help prevent recurrence of urinary calculi formation, a low-protein diet with a calcium to phosphorus ratio of 2:1 and oral ammonium chloride administration (25 mg/kg of body weight, q 24 h, initially; thereafter an amount necessary to stabilize urinary pH around 5.5 to 6.0) was recommended.[1,4] After 6 weeks of sexual rest, the buck was placed with does in estrus. At that time, the owner reported the buck would mount readily but was unable to achieve erection.

The only abnormality found on examination was the inability to achieve erection. The penis was extended easily, and the penis and prepuce were free of scar tissue. Innervation of the glans penis appeared to be normal, as evidenced by the buck's vocalization upon manual extension of the penis. Engorgement of the penis was not observed when semen was collected by electroejaculation.

Contrast radiography of the corpus cavernosum penis (CCP) was performed to identify the cause of impotence.[5-7] General anesthesia was induced and maintained using a continuous intravenous infusion of guaifenesin[a] (50 mg/ml), ketamine hydrochloride[b] (1 mg/ml) and xylazine hydrochloride[c] (0.1 mg/ml) in 5% dextrose[d] in water solution at a dosage of 1.2 ml/kg for induction and 2.6 ml/kg/h for maintenance.[8] The penis was manually extended and secured with an umbilical tape loop placed caudal to the glans penis. A 0.6-mm suture was placed through the sheath, between the retractor penis muscles and the penis and proximal to the muscular attachment near the distal bend of the sigmoid flexure. The suture was then placed through the opposite side of the sheath. Traction on this suture was used to retract the penis from the abdominal wall, which facilitated obtaining lateral radiographic views of the sigmoid flexure.

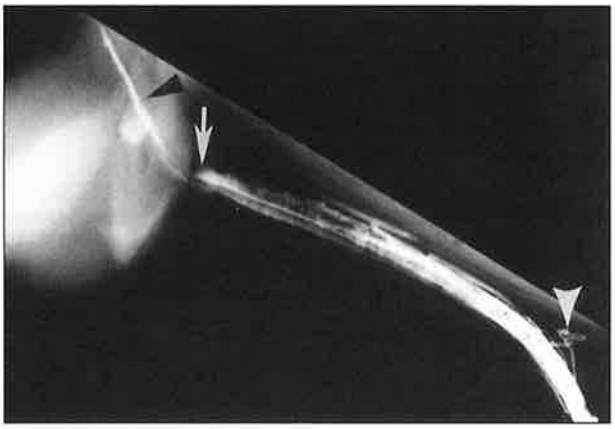

Figure 1—Lateral positive-contrast radiographic view of the corpus cavernosum penis (CCP). The distal portion of the CCP is filled with contrast medium to the vascular obstruction at the distal bend of the sigmoid flexure (white arrow). Leakage of contrast medium at the injection site due to back pressure (white arrowhead) produced a venogram (black arrowhead) extending proximal to the CCP blockage.

With the penis extended, 15 ml of contrast medium[e] was injected into the CCP over 5 seconds via an 18-gauge needle placed through the tunica albuginea proximal to the glans penis. Contrast radiography revealed normal filling of the cavernous spaces of the CCP distal to the distal bend of the sigmoid flexure (Fig 1). However, filling was not observed proximal to the sigmoid flexure. Additionally, leakage of contrast media at the injection site was evident outside the tunica albuginea. This was attributable to back pressure that developed because the injected contrast medium could not flow proximal to the obstruction.[5,6]

A diagnosis of obstruction of blood flow through the CCP caused by fibrosis secondary to urolithiasis was made. A poor prognosis was given for return to breeding soundness. Six months later, contact with the owner indicated that the buck was still unable to achieve an erection.

From the Department of Large Animal Surgery and Medicine, College of Veterinary Medicine, Auburn University, AL 36849-5522. Dr. Todhunter's present address is Canberra Veterinary Hospital, PO Box 105, Lyneham ACT, 2602, Australia.

Address correspondence to Dr. Wolfe.

Obstructive urolithiasis in small ruminants has been reviewed.[1-3] Amputation of the urethral process may provide only short-term relief, but does not affect breeding potential.[1,2,9] Because of a high prevalence of urethral stricture following penile urethrostomy, reobstruction is common, and the prognosis for future breeding soundness is poor.[2,3,9] Cystotomy has been advocated as the most successful long-term treatment.[2,9] Recently, in addition to cystotomy, a technique of inserting an indwelling Foley catheter through the ventral abdominal wall and into the urinary bladder has been reported.[1] The catheter provides a diversion for urine flow, allowing time for urethral inflammation and spasm to subside. Using this technique, exposure of urinary calculi to acidified urine is achieved by closing the catheter for increasing time intervals. The urinary calculi will then partially dissolve and pass. Additionally, avoiding an incision into the urethra by use of this technique lessens the prevalence of stricture and recurrent obstruction, and breeding potential should be maintained.

Impotentia erigendi, or erectile impotence, may be caused by a lack of libido or physiologic and anatomic abnormalities.[10] Common conditions associated with erectile impotence include preputial stenosis, retropreputial adhesions, penile deviations and anesthesia of the glans.[11,12] The buck in this report, however, did not have any of these conditions. Impotence was assumed the result of defective blood flow to, within, or from the CCP.[5,10,12-16]

Traditionally, vascular anomalies have been diagnosed on assumptions made at antemortem examination and definitively only at postmortem examination.[11] However, using contrast radiography of the CCP, a definitive diagnosis of vascular anomalies can be made routinely in live bucks.[6,13,14]

The mechanism of erection and related anatomy has been described.[7,12,16] Sexual stimulation results in dilatation of deep arteries within the crus penis. Active rhythmic contractions of the ischiocavernosus muscles force blood into the dorsal canal and vascular spaces of the CCP. As the ischiocavernosus muscles contract, they occlude the sole venous drainage at the crus penis, allowing the CCP to become a closed vascular system. Abnormal vascular anastomoses that shunt blood from the CCP through the tunica albuginea to the extracorporeal circulation prevent the development of the closed vascular system and result in erection failure. These vascular shunts may be congenital or acquired[10,12,13,15,16] and may be diagnosed by use of contrast radiography of the CCP.[6]

Alternatively, interference with blood flow through the CCP will prevent erection. Blockage of blood flow through the CCP proximal to the sigmoid flexure may result in erection failure, and partial blockage of blood flow distally may result in penile deviation. The results of contrast radiography of the CCP will indicate areas of vascular filling defects. Complete blockage of blood flow through the CCP, as in this buck, will result in failure of the contrast medium to migrate proximally to the vascular obstruction.[5-6]

Blockage of blood flow through the CCP in human beings may be the result of a congenital defect, trauma, or septic cavernitis or fibrotic cavernitis.[17,18] Diagnosis by use of contrast radiography of the CCP, and, more recently, magnetic resonance imaging is well established in human medicine.[17,19]

In bulls, fibrosis of the dorsal canal in the presigmoidal portion of the CCP, presumably secondary to intrapenile trauma and hematoma, has been reported.[11] Penile hematomas more commonly cause impotence through shunt formation or adhesions than through blockage of blood flow through the CCP. Vascular disease, such as subendothelial thickening and mural thrombosis of the dorsal canal, may predispose the CCP to proximal hematoma formation.[14,15] Congenital blockage of blood flow through the CCP may also exist.[14]

To our knowledge, blockage of blood flow through the CCP secondary to obstructive urolithiasis or urethral rupture has not been reported. The buck in this report was capable of intromission prior to the second episode of urethral obstruction. We believe, therefore, there is a causal relationship between urethral obstruction and vascular obstruction of the CCP. Cavernitis may have been induced by urethritis or leakage of urine from a ruptured urethra. Fibrosis, subsequent to obstructive urolithiasis or urethral rupture, may have occluded the vascular spaces of the CCP.

[a]Guaifenesin, Fort Dodge Laboratories Inc, Fort Dodge, Iowa.
[b]Ketaset, Fort Dodge Laboratories Inc, Fort Dodge, Iowa.
[c]Rompun 100 mg/ml, Miles Inc, Shawnee Mission, Kan.
[d]Baxter Healthcare Corp, Deerfield, Ill.
[e]Renograffin-76, Squibb Diagnostics, New Brunswick, NJ.

References

1. Rakestraw PC, Fubini SL, Gilbert RO, et al. Tube cystostomy for treatment of obstructive urolithiasis in small ruminants. *Vet Surg* 1995;24:498–505.
2. Haven ML, Bowman KF, Engelbert TS, et al. Surgical management of urolithiasis in small ruminants. *Cornell Vet* 1993;83:47–55.
3. Van Weeren PR, Klein WR, Voorhout G. Urolithiasis in small ruminants. I. A retrospective evaluation of urethrostomy. *Vet Q* 1987;9:76–79.
4. Crookshank HR. Effect of ammonium salts on the production of ovine urinary calculi. *J Anim Sci* 1970;30:1002–1004.
5. Carson RL. Corpus cavernosal filling defects, in *Proceedings*. 1st Hudson-Walker Theriogenology Symp 1990;47–49.
6. Moll HD, Wolfe DF, Hathcock JT. Cavernosography for diagnosis of erection failure in bulls. *Compend Contin Educ Pract Vet* 1993;8:1160–1165.
7. Beckett SD, Reynolds TM, Bartels JE. Angiography of the crus penis in the ram and buck during erection. *Am J Vet Res* 1978; 39:1950–1954.
8. Lin H-C, Tyler JW, Wells EG, et al. Effects of anesthesia induced and maintained by continuous intravenous administration of guafenesin, ketamine, and xylazine in spontaneously breathing sheep. *Am J Vet Res* 1993;54:1913–1916.
9. Van Metre DC, Smith BP. Clinical management of urolithiasis in small ruminants, in *Proceedings*. 9th Am Coll Vet Intern Med Forum 1991;555–557.
10. Glossop CE, Ashdown RR. Cavernosography and differential diagnosis of impotence in the bull. *Vet Rec* 1986;118:357–360.
11. Hudson RS. Thrombosis of the corpus cavernosum penis in a bull. *J Am Vet Med Assoc* 1971;159:754–756.
12. Hudson RS, Beckett SD, Walker DF. Pathophysiology of impotence in the bull. *J Am Vet Med Assoc* 1972;161:1345–1347.
13. Ashdown RR, David JSE, Gibbs C. Impotence in the bull.

1. Abnormal venous drainage of the corpus cavernosum penis. *Vet Rec* 1979;104:423–428.

14. Ashdown RR, Gilanpour H, David JSE, et al. Impotence in the bull. 2. Occlusion of the longitudinal canals of the corpus cavernosum penis. *Vet Rec* 1979;104:598–603.

15. Ashdown RR, Glossop CE. Impotence in the bull. 3. Rupture of the corpus cavernosum penis proximal to the sigmoid flexure. *Vet Rec* 1983;113:30–37.

16. Beckett SD, Purohit RC, Reynolds TM. The corpus spongiosum penis pressure and external penile muscle activity in the goat during coitus. *Biol Reprod* 1975;12:289–292.

17. Ney C, Miller HL, Friedenberg RM. Various applications of corpus cavernosography. *Radiology* 1976;119:69–73.

18. Smith AD. Causes and classification of impotence. *Urol Clin North Am* 1981;8:79–89.

19. Hricak H, Marotti M, Gilbert TJ, et al. Normal penile anatomy and abnormal penile conditions: evaluation with MR imaging. *Genitourin Radiol* 1988;169:683–690.

Book Review:
Understanding Neuroscience. *By William R. Klemm. 292 pages; illustrated. Mosby-Year Book Inc, 11830 Westline Industrial Dr, St Louis, MO 63146-3318. 1996. Price $19.95.*

The book is the first of a series of books, each of which will focus on a different biomedical discipline (ie, anatomy, biochemistry, endocrinology, immunology, microbiology, parasitology, pathology, pharmacology, and physiology). The series is referred to as Mosby's Biomedical Science Series. In view of the rapid growth of knowledge in biomedical sciences, the objective of this series is to identify the major scientific principles that are well defined for each discipline and to leave out many details that are included in other reference textbooks. When used as a textbook, instructors would be expected to provide additional information that would build on these principles through the use of traditional lectures or problem- or case-based learning modules.

Each chapter begins with a general introduction of the topic. The introduction is followed by a list of principles with brief definitions. Each principle is presented in additional detail, special terms are defined, and several carefully selected references are listed, including some that are classics in the author's view of their importance to establishment of a particular principle. Each chapter ends with a list of study questions. Considerable emphasis has been placed on information processing, states of consciousness, emotions, and learning and memory. The book should be valuable to readers interested in an overview of neuroscience. Its unique organization should help students develop information management skills. Figures are relatively simple, but are appropriate for support of discussions of principles. The price is reasonable for a softcover book of this size.

John M. Bowen, DVM, PhD