Outcome of scrotal hydrocele in 26 bulls

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- A change in scrotal circumference is not a good indicator of disease progression or prognosis in bulls with scrotal hydrocele.
- Substantial improvement in spermatozoal morphologic characteristics may not be detected for several months after resolution of scrotal hydrocele.
- Finding of multifocal echodensities in the testicular parenchyma in bulls with scrotal hydrocele may not be correlated with a poor breeding soundness score or with a high number of spermatozoal abnormalities.

Twenty-six bulls with scrotal hydrocele were identified during routine breeding soundness evaluation of 600 bulls of various breeds at 2 separate locations in East Central Texas. All bulls received a brief physical examination, followed by a standard breeding soundness evaluation in which criteria recommended by the Society for Theriogenology were used.[1] This included scrotal measurements and evaluation of spermatozoal motility and morphologic features. Bulls with palpable scrotal changes also were examined ultrasonographically. Those with a fluid layer between the parietal and visceral tunics > 0.2 cm were considered to have scrotal hydrocele.

On initial examination, all affected bulls were afebrile and apparently healthy, with body condition scores ranging from 5 to 7 on a scale of 1 (emaciated) to 9 (grossly obese).[2] The testes were freely movable within the fluid in the vaginal process and, in some bulls, seemed palpably softer than normal. Scrotal circumference measurements ranged from 39 to 59 cm in affected bulls.

Ultrasonographic examinations were performed by use of a commercially available portable ultrasound unit with a 5-MHz linear array transducer.[a] Ultrasound gel was applied to the scrotum, and oblique sagittal and transverse evaluations were made of each hemiscrotum. Oblique sagittal and transverse evaluations were generated from a caudal position by holding the most dorsal aspect of the scrotum dorsal to the testes and firmly positioning the testes ventrally into the scrotum, as if taking a scrotal measurement. The linear transducer then was oriented vertical to the scrotum, placed on the median raphe, and fanned laterally so that the long axis of each testis and the surrounding structures were evaluated. With this technique at the midtestis level, fluid accumulations in the vaginal process were observed, and the fluid-filled distance between the visceral and parietal tunics was measured.

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Ultrasonographically, the visceral and parietal tunics of the testis of affected bulls were easily identified as discrete echogenic lines separated by fluid. Fluid was observed in sagittal and transverse views, but was observed most consistently from the sagittal view. The amount of fluid within the vaginal process of bulls with hydrocele varied from 0.4 to 3.0 cm on oblique sagittal views. The testicular parenchyma, in most cases, appeared to be uniform and moderately echogenic throughout. Scattered hyperechoic foci within the testicular parenchyma were sometimes observed. The mediastinum testis was clearly evident as an echodense area in the center of the testis. When fluid was detected in the vaginal process, the pampiniform plexus and the head and tail of the epididymis were easily identified.

Semen was collected from affected bulls by electroejaculation. Semen samples were diluted with physiologic saline solution and evaluated for percentage of progressively motile spermatozoa, using a light microscope. Semen smears were stained with eosin-nigrosin,[b] and 100 spermatozoa were evaluated for normal morphologic features. Bulls with at least 30% progressively motile spermatozoa and 70% morphologically normal spermatozoa were considered to be satisfactory potential breeders.

A differential count of spermatozoal abnormalities (spermiogram) also was generated. Abnormal spermatozoal morphologic features were classified according to Blom, as cited by Barth and Oko.[3] Using this classification system, spermatozoal abnormalities are designated as major or minor, according to the importance of the abnormality to fertility. Major spermatozoal defects include acrosome defects (knobbed), pyriform heads, double forms, detached pathologic heads, nuclear vacuoles, underdeveloped heads, proximal droplets, and tightly coiled tails (Dag defect). Minor spermatozoal defects include small normal heads, normal detached heads, abaxial implantation, distal droplets, distal reflex, and terminally coiled tails. At initial examination, only 5 of 26 (19%) bulls had semen of sufficient quality to pass a breeding soundness evaluation.

Examinations were repeated in affected bulls at 45, 60, 90, and 120 days after the initial examinations. Over 120 days of observation, changes in scrotal circumference were highly variable among affected bulls. Scrotal circumference in 1 bull with bilateral scrotal hydrocele decreased 12 cm (from 53 to 41 cm) in 120 days, compared with as little as a 2-cm reduction in a bull affected unilaterally. Changes in most bulls were a decrease of 3 to 4 cm. Of the 26 bulls, 18 had unilateral scrotal hydrocele (17 involved the left hemiscrotum, and 1 involved the right). The remaining 8 bulls were bilaterally affected.

Repeated ultrasonographic examinations revealed that the rate at which excess fluid disappeared from the vaginal process varied among bulls. After 45, 60, 90, and 120 days, the scrotal hydrocele had resolved (ultrason-

Table 1—Percentage (No.) of bulls in which unilateral or bilateral scrotal hydrocele, initially identified on day 0, had resolved within 120 days of observation

Observation time (d)	Bulls with hydroceles	
	Unilateral	Bilateral
45	44 (8/18)	0 (0/8)
60	50 (9/18)	12.5 (1/8)
90	94 (17/18)	37.5 (3/8)
120	94 (17/18)	62.5 (5/8)

Table 2—Percentage (No.) of bulls with unilateral or bilateral scrotal hydrocele on day 0 that had adequate spermiograms within 120 days of observation

Observation time (d)	Bulls with hydroceles	
	Unilateral	Bilateral
0	17 (3/18)	25 (2/8)
45	22 (4/18)	0 (0/8)
60	33 (6/18)	0 (0/8)
90	50 (9/18)	12.5 (1/8)
120	83 (15/18)	62.5 (5/8)

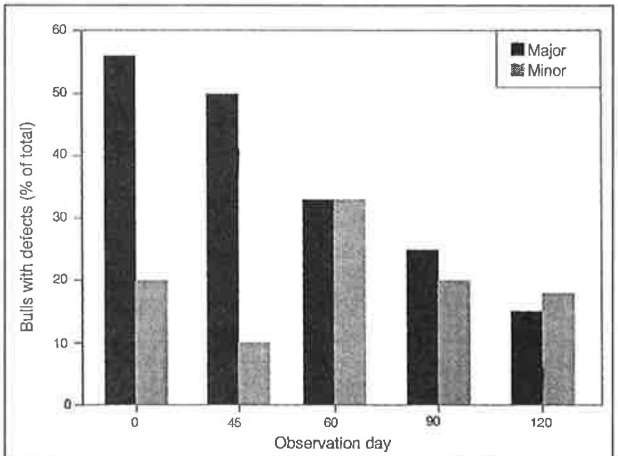

Figure 1—Prevalence of major and minor spermatozoal defects in 26 bulls with a history of scrotal hydrocele. Observation days are numbered from time of initial evaluation.

ographically, fluid was not detectable within the vaginal cavity) in 8 (30%), 10 (38%), 20 (77%), and 22 (85%) of the 26 bulls, respectively. Bulls that were unilaterally affected had a higher percentage with resolution of scrotal hydrocele (17/18; 94%), compared with that in bulls with bilateral fluid accumulations (5/8; 62.5%; Table 1).

The scattered hyperechoic foci within the testicular parenchyma of 8 bulls persisted even after the hydrocele had resolved. Six of those 8 bulls passed a breeding soundness evaluation by the end of the 120-day observation period. In 1 bull, a large (1.0 × 2.0 cm), echodense lesion in the mediastinum of the left testis developed and eventually generated an acoustic shadow, presumably as a result of testicular fibrosis and mineralization. That bull passed a breeding soundness evaluation at 120 days.

During the 120-day observation period, semen quality gradually improved in affected bulls, with 20 of 26 (77%) passing a breeding soundness evaluation at 120 days. Semen quality was restored more quickly in bulls with unilateral disease than in those with bilateral disease (Table 2). Two of 8 bulls with bilateral scrotal hydrocele retained fluid in the vaginal cavity after 120 days, yet had satisfactory semen quality. Within individual bulls, major defects predominated for the first 90 days (Fig 1). The most common observed defects were nuclear vacuoles, pyriform heads, tapered heads, and teratoid forms. After 90 days, minor defects (bent tails and distal droplets) were more often observed.

Scrotal hydrocele has been more frequently reported in the medical literature than in veterinary literature. In certain tropical areas, scrotal hydrocele is the hallmark of chronic bancroftian filariasis and may be found in 25% or more of the adult male population.[4] In temperate climates, most human cases are sporadic and can be related to infection, tumors, or trauma.[5] In bulls, individual cases of scrotal hydrocele have been observed,[6] but often the cause is idiopathic,[6,7] and follow-up information is unavailable. Because little is known about the prognosis for scrotal hydrocele and associated effects on reproductive function in bulls, we evaluated scrotal sonographic changes and semen quality of bulls with scrotal hydrocele over a 4-month period.

The pathogenesis of acquired hydrocele is unclear. In human beings, acquired scrotal hydrocele is reportedly caused by lymphatic obstruction.[8] Researchers have hypothesized that lymphostasis and venous congestion initiate the formation of the hydrocele by increasing fluid volume and hydrostatic pressure within the vaginal process.[9] Impaired vascular wall permeability leads to deterioration of the microcirculation, preventing accumulated fluid from returning to the vascular system. Little is known about the etiopathogenesis of acquired scrotal hydrocele in bulls. In bulls in a recent report,[c] similarities in the transudate obtained from the vaginal tunics and abdomen were suggestive of a common source. Because the vaginal process in animals communicates directly with the peritoneal cavity,[10] scrotal hydrocele in those bulls was concluded to have resulted from fluid draining from the abdomen into the vaginal process. With this conclusion, scrotal hydrocele was secondary to a pathologic process associated with ascites.

Scrotal circumference under typical circumstances varies among breeds and is subject to the age and weight of the bull. With few exceptions, scrotal circumference of individual bulls in this report changed little over the 120-day observation period. This finding suggested that a change in scrotal circumference, by itself, is not a good prognostic indicator in cases of scrotal hydrocele, and it is not useful to measure the progression of the condition.

Ultrasonography has been used to differentiate or evaluate conditions such as scrotal hydrocele, hematoma, orchitis, epididymitis, testicular neoplasia, and testicular torsion in human beings,[11,12] bulls,[13] goats,[14] dogs,[15,16] and horses.[17] In the bulls in this report, the ultrasonographic appearance of the scrotum and its contents was similar to that previously described.[13] The testicular parenchyma appeared homogeneous in texture and contained a centrally located, hyperechoic mediastinum testis. The visceral and parietal tunics were evident ultrasonographically as discrete hyperechoic lines, separated by the fluid-filled vaginal process. In the previous study of sonographic anatomy,[13] lack of fluid in the vaginal process was most common. However, a thin layer (< 0.2 cm) of sonolucent fluid in the vaginal process was sometimes observed and considered normal, suggesting that fluid accumulation in excess of 0.2 cm may be considered abnormal. Standardizing measurements is difficult, however, because of fluid shifts within the scrotum with manipulation.

The appearance of multifocal echodensities within the testicular parenchyma of a few bulls was similar to lesions previously described.[13] In that study of abattoir specimens, echogenic foci in the parenchyma of the testis were suggested to be testicular fibrosis or mineralization. When gross and histopathologic findings were compared with ultrasonographic observations from induced testicular lesions in goats, areas of high echogenicity corresponded well to histopathologic findings in areas of fibrosis and tubular mineralization.[14] Our findings also were similar to those of Eilts and Pechman[18] in that the presence of multifocal echodensities in the testicular parenchyma was not correlated with a poor breeding soundness score or with a high number of spermatozoal abnormalities. Echodensities within the testicular parenchyma may be indicative of tubular fibrosis, calcification, and irreversible testicular degeneration; however, the degree to which these echodensities existed in our bulls did not appear to affect spermatogenesis. Six of 8 bulls with numerous persistent hyperechoic foci in 1 or both testes near the beginning of the observation period passed breeding soundness evaluations 120 days later. The importance of testicular echodensities as they relate to age, injury, and functional spermatogenesis has yet to be determined.

The cause of the negative effect of a hydrocele on spermatozoal function and fertility also is uncertain. A large hydrocele surrounds the testis with an abnormal insulating layer of fluid that may impair the efficiency of the countercurrent heat-exchange mechanism, resulting in increased testicular temperature and impaired spermatogenesis. Men with scrotal hydrocele have significantly higher intratesticular temperatures.[19] Normally, the testes in bulls are maintained very close to 34.5 C. Even slight increases in testicular temperature (0.5 C) reportedly cause major disturbances in spermatogenesis. In bulls, insulation of the scrotum that raised the skin temperature to 35 C for 10 to 20 hours resulted in decreased semen quality, starting 3 weeks after insulation and reaching a peak between 3 and 10 weeks. Semen quality was normal 13 weeks after the thermal insult.[20] Lagerlof[21] showed that scrotal insulation of bulls for 4 to 5 days did not noticeably reduce production of spermatozoa, but caused a considerable increase in the number of pathologic spermatozoa. With more prolonged insulation (11 to 16 days), production of spermatozoa rapidly decreased, and most spermatozoa were abnormal. Barth[22] reported that scrotal insulation in bulls for 4 days caused an increase in the number of distal midpiece reflexes, proximal droplets, mitochondrial sheath disruptions, detached heads, knobbed acrosomes, nuclear vacuoles, coiled principal pieces, and pyriform heads and a concurrent decrease in serum and tissue testosterone concentrations beginning 7 days after insulation. Normal spermatogenesis was restored by 6 weeks after insulation. Similar defects were observed after scrotal insulation for 48 hours.[23]

The spermiogram can be considered a reflection of the health of the seminiferous epithelium at the time of spermiogenesis and reflects the health of the epididymis during spermatozoal transit and storage in the epididymis. Major spermatozoal defects result from pathologic processes in the germinal tissue. The number of major defects is increased following stress, injury, illness, or heat. Many of the spermatozoal morphologic defects observed in the bulls with scrotal hydrocele in this study were consistent with those found in bulls exposed to severe environmental stress or high scrotal temperatures. Barth[22] proposed that the sequential development of various defects was related to their respective position in spermiogenesis at the time of cell injury and to the time required for the injured cell to be released into the lumen of the seminiferous tubules and transported through the epididymis. Barth also stated that the severity and duration of the abnormal spermiogram were associated with the severity and duration of the insult. Changes in the spermiograms of bulls in this study suggested a temporal disturbance of spermatogenesis associated with the presence and resolution of the scrotal hydrocele.

The finding of a single abnormal spermiogram often raises questions that are difficult to answer. Complete recovery to normal production of spermatozoa has been reported in bulls after initial observation of a high number of spermatozoal defects, including proximal droplets[3] and pyriform heads and detached heads.[24] The prognosis and the time required for recovery would likely vary among bulls, however, according to the severity of the insult and the time between the insult and examination. Although substantial improvement in spermatozoal morphologic characteristics lagged 60 to 90 days behind resolution of the scrotal hydrocele in most of the bulls in this report, degenerative changes in the seminiferous epithelium, as evidenced by a high percentage of major defects in the initial spermiogram, were not permanent in nature. Because we did not know the time of onset of scrotal hydrocele in these bulls, we cannot accurately report the temporal relationship between onset of hydrocele and duration of an abnormal spermiogram. In this report, some bulls with chronic hydroceles eventually passed breeding soundness examinations, but because of the prolonged exposure to insult, these bulls required as much as 4 months for semen quality to improve.

[a]Corometrics 210 DX, Corometrics Medical Systems Inc, Wallinford, Conn.

[b]Society for Theriogenology, Hastings, Neb.

[c]Abbitt B, Texas Veterinary Medical Diagnostic Laboratory, College Station, Tex: Personal communication, 1994.

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Pharmacologic interaction of furosemide and phenylbutazone in horses

Six healthy, conscious mares were administered 3 treatments in a randomized, blinded study—furosemide (1 mg/kg of body weight, IV) only, phenylbutazone (8.8 mg/kg, PO, at 24 hours and 4.4 mg/kg, IV, 30 minutes before furosemide) and furosemide, or 0.9% NaCl—and hemodynamic variables, including urine flow, were measured. Phenylbutazone did not inhibit equally the diuretic and hemodynamic effects of furosemide, leading to the conclusion that some of furosemide's hemodynamic effects are mediated by extrarenal activity of the drug.—*K. W. Hinchcliff, K. H. McKeever, W. W. Muir III, et al in Am J Vet Res 56 (September 1995).*