Diagnosis, surgical treatment, and performance after unilateral castration in breeding bulls: 21 cases (1989–1999)

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Objective—To evaluate signalment, surgical treatment, postoperative complications, and future breeding success or semen production in a group of bulls with naturally occurring disease of the scrotum or testis.

Study design—Retrospective study.

Animals—21 bulls that underwent unilateral castration after evaluation for scrotal swelling.

Procedure—A computer-assisted search of medical records at 2 veterinary teaching hospitals was performed. Historical, diagnostic, surgical, and follow-up data were collected and analyzed for those bulls with scrotal swelling that underwent unilateral castration.

Results—Four of 5 pasture breeding bulls and 9 of 10 semen collection-center bulls successfully bred cows or produced viable semen within 6 months of surgery. Seventy-one percent of bulls developed postoperative complications, most of which were mild swellings. Unilateral castration returned 13 of 15 bulls with unilateral disease of the scrotum or testis to productive service by 6 months after surgery.

Conclusion and Clinical Relevance—Unilateral castration is an effective treatment for unilateral disease of the scrotum or testis in bulls, allowing return to reproductive function. (J Am Vet Med Assoc 2002; 220:1198–1202)

Scrotal and testicular abnormalities are common among breeding bulls.1–6 However, detailed data regarding diagnosis, surgery, surgical complications, and long-term effects on semen production are limited. Scrotal abnormalities often are noticed during routine breeding soundness examination, semen collection, or pasture breeding activities. Most scrotal abnormalities are unilateral,1 and involvement of the left testicle has been reported more commonly than involvement of the right testicle.7 Abnormalities of the external genitalia occur in the scrotum, testicles, epididymides, spermatic cord structures, inguinal rings, and potential spaces within the scrotum. Reports of testicular tumors are rare in cattle.6,8

To our knowledge, only 2 studies4,5 have critically evaluated unilaterally castrated bulls after surgery to estimate future fertility. The first report evaluated semen data in clinically normal research bulls for 8 weeks after unilateral castration, but no spermatozoa production or semen concentration data were given. Also, the semen was collected by use of electroejaculation, which may affect the concentration and percentage of normal spermatozoa, compared with semen collected by use of an artificial vagina. The second study7 only examined 8 pasture-breeding beef bulls and reported successful breeding after surgery in 5 of 8 bulls, based on conception in cows. Semen data were collected for only 2 of these bulls, and only 1 bull produced freezeable-quality semen. Follow-up times ranged from 1 month to 3 years after surgery. Little discussion was done regarding diagnosis, treatment, and postoperative complications in these bulls. Thus, limited data are available upon which to base prognosis for future performance of bulls after unilateral castration. We hypothesized that bulls return to acceptable levels of semen production or reproductive soundness after unilateral castration. The purpose of this study was to examine signalment, surgical treatment, postoperative complications, and future breeding success or semen production in a group of bulls after unilateral castration.

Criteria for Selection of Cases

A computer-assisted search of the medical records at 2 veterinary teaching hospitals was performed to identify bulls that were evaluated for scrotal swelling between January 1989 and December 1999. Only those bulls that had undergone unilateral castration were included in the study.

Procedures

Medical records were analyzed to obtain signalment, referral complaint, duration of condition, physical examination findings, ultrasonography findings, semen analysis results at time of evaluation, ancillary diagnostic test results, surgical procedure, anesthesia used, gross pathologic and histopathologic results from the removed tissues, results of microbial culture, postoperative complications, medical treatment used, dura-
Results

Medical records were obtained for 21 bulls. Ten bulls were Holsteins, and 11 bulls were of beef breeds. Eleven bulls were pasture bulls, while 10 bulls were from a semen collection center. Breeds represented were Holstein (n = 10), Hereford (3), Limousin (2), Simmental (2), Angus (1), Maine Anjou (1), Salers (1), and Shorthorn (1). The bulls ranged in age from 1 year old to 7 years old (mean ± SD, 3.70 ± 2.07 years). Eleven bulls were referred with abnormalities of the right hemi-scrotum, and 10 had left hemi-scrotum abnormalities. The most common complaint was unilateral scrotal swelling (n = 17). Three bulls were referred because of reduced semen quality.

Seven bulls had previous testicular or scrotal abnormalities observed 5 weeks to 12 months before examination. Two bulls had history of recent trauma to the scrotum and testicles. The duration of clinical signs prior to referral was noted for 13 of 21 bulls and varied widely from 24 hours to 1 year (median, 36 days; mean, 66.4 ± 95.0 days). Pasture bulls had longer duration of disease (mean, 103.4 days) prior to referral, compared with that of semen center bulls (mean, 19.8 days; P < 0.04). Eight bulls had previously been examined for the same problem.

All bulls were in good physical health at referral. The principal abnormalities detected via physical examination involved the scrotum, testicle, or spermatic cords for all bulls. Scrotal swelling was unilateral in 16 of 17 bulls. The 1 bull with bilateral swelling was unilaterally castrated at the owner's request and was included in the study despite poor prognosis. Three bulls had 1 nonmovable testicle within the scrotal sac. Pain upon palpation of the scrotum was detected in 4 bulls. Epidydymal abnormalities were detected in 4 bulls. Inguinal hernias were diagnosed in 5 bulls, and herniated viscera could be reduced manually in 4 of 5 bulls. The left inguinal ring was involved in 4 of the 5 bulls. Scrotal circumference was measured at referral in 9 bulls and ranged from 29.5 to 54 cm (mean, 43.8 ± 8.4 cm). No abnormalities of the accessory sex glands were noted in the medical records.

Sixteen bulls received ultrasonographic examination. Abnormalities included diffuse or localized hypoechogenic fluid within the testicular stroma (n = 8), hyperechoic tissue within the testicle (4), cystic structures within testicular stroma (3), hyperemic tissue surrounding the testicle (7), fluid surrounding the testicle (7), epididymal dilation or fibrin accumulation (3), and intestinal loops in the scrotum (2). Most of the abnormalities were detected in the affected testicle, but 3 bulls also had abnormalities in the stroma or in the surrounding tissues of the contralateral testicle.

A CBC was performed on 5 bulls; for 4 bulls results were within reference ranges, and 1 bull had mild lymphocytosis, considering the bull's age (8,662 lymphocytes/µl; reference range, 2,500 to 7,500 lymphocytes/µl). One bull in which testicular lymphosarcoma was later detected was seropositive for bovine leukemia virus.

Fourteen of 21 procedures were performed under general anesthesia, 3 were performed using sedation and local infiltration with lidocaine, 3 with local infiltration of lidocaine only, and 1 with epidural anesthesia and local infiltration. Surgeries performed under general anesthesia were performed in lateral recumbency. Six of the 7 surgeries performed with local or regional anesthesia were performed with the bull on a foot-trim table in lateral recumbency. One hemicastration was performed as a standing procedure (with epidural and local anesthesia).

Detailed surgical reports were available for 18 bulls. The tunica vaginalis was opened in 12 bulls and remained closed in 6. In 11 bulls, the components of the spermatic cord were reported to have been ligated individually, and the remainder of the reports indicated a closed castration or no indication of technique. All reports indicated that an emasculator was used on the cord or cord components prior to removal. In 1 report, a distinct testicle could not be identified in the scrotum because of the presence of a large amount of fibrinous exudate. Nine of 21 surgery reports indicated that the subcutaneous tissues, tunics, or both were closed separately prior to skin closure, while skin only was closed in the remaining 12 bulls. Eleven surgical sites were closed completely with suture, while 9 of the reports indicated that the scrotum was closed over gauze or sterile towel packing such that the ventral aspect of the incision in the scrotum was open to permit drainage. In the remaining bull, skin closure was performed such that the ventral 3 cm of the incision was left open without the use of packing material. For 3 bulls, procaaine penicillin was infused into the open space in the scrotum before skin closure.

For 16 bulls, testicles were submitted for histologic examination. Of these 16 testicles, 7 had tubular atrophy, 5 had interstitial orchitis, 3 had epididymitis, 2 had tumors (1 lymphosarcoma and 1 Sertoli cell tumor), 2 had epididymal fibrosis, 1 had epididymal spermatozoal granulomas, 1 had coagulation necrosis and hemorrhage, and 1 had granulation tissue and exudate only. Several testicles had multiple abnormalities. Bacteriologic culture of the tissues was performed in 4 bulls and yielded no growth in 1 bull, Escherichia coli in 1, Enterococcus faecalis in 1, and coagulase-negative Staphylococcus spp in 1.

Nineteen of 21 bulls were treated with antimicrobials after surgery. Eighteen were treated with procaine penicillin (22,000 U/kg [10,000 U/lb], IM, q 24 h) for a mean of 5 days (range, 2 to 17 days), whereas 1 bull was treated with ceftiofur hydrochloride (1.1 mg/kg [0.5 mg/lb], IM, q 24 h) for 4 days. Seven bulls were treated with phenylbutazone (5 mg/kg [2.3 mg/lb], PO, q 24 h or 10 mg/kg [4.5 mg/lb], PO, q 48 h) for various periods after surgery, and 1 bull received flunixin meglumine (1.1 mg/kg, IM, once). Eleven
bears received daily hydrotherapy beginning 2 or 3 days after surgery to treat swelling and pain. Three bulls had the scrotum flushed daily with dilute iodine solution in water after surgery. Nine bulls had packing placed in the scrotum; this material was removed on the second or third day after surgery. Eighteen bulls were hospitalized (mean, 13.2 ± 6.8 days).

Six (29%) bulls did not have postoperative complications noted in the medical record. Various degrees of swelling and drainage were noticed during the first 3 days after surgery in 15 (71%) bulls. Swelling remained for as long as 2 weeks after surgery in 3 (14%) bulls. Incisions dehisced in 2 (5%) bulls, and this was attributed to postoperative swelling or infection. Incisions were reopened in 5 (24%) bulls because of excess swelling and drainage or obstruction of drainage.

Of 11 bulls that had the scrotum completely closed at surgery, only 1 bull had sutures removed because of excess swelling after surgery, while the other 10 had only slight swelling that was managed by use of hydrotherapy. Of 9 bulls that had packing of some sort placed into the scrotum during closure of the skin, dehiscence was reported in 2 bulls, and sutures had to be removed from 2 other bulls because of excessive swelling and suture tension. The remaining 5 bulls in this group had mild swelling that was managed by use of hydrotherapy. In the remaining bull of the 21 bulls, a ventral drainage opening was left at surgery, as indicated by calvings in exposed cows. A second bull was reported to have improved semen quality 2 months after surgery but was lost to further follow-up. Breeding soundness examination results were reported by the third owner 3 months after surgery, which indicated 90 to 95% spermatozoa motility, and freezable quality semen was being collected from the bull. The fourth owner reported breeding soundness examination results 4 months after surgery, which indicated excellent spermatozoa morphologic characteristics (80% normal) but reduced motility (25 to 35%). The breeding soundness examination performed at the teaching hospital on the fifth bull 10 weeks after surgery produced no semen by use of electroejaculation, and classification was deferred.

Follow-up on semen-center bulls was available for 10 bulls in the form of semen analysis data or final outcomes. Of these bulls, 6 had been sold to slaughter 7 months to 5 years after surgery because of inferior progeny test results. Two of the 10 were returned to the farm of origin because of adequate semen inventory. Two of 10 remained in the young sire herd, awaiting outcome of progeny testing. Detailed postoperative semen data were available for 9 bulls. Eight of 9 bulls had acceptable semen production within 6 months after surgery. One bull that did not return to acceptable production had bilateral testicular disease. After surgery, this bull produced poor quality semen with large numbers of abnormalities and low motility.

Discussion

Unilateral castration can permit return to productive service for bulls used for natural service or semen collection. Some bulls fail to return to productive use because of damage to the contralateral testicle or epididymis. These effects could not be adequately assessed prior to surgery, and the potential for poor future productivity should be discussed with owners during the treatment decision process before surgery. The stud bull that did not return to normal semen production after surgery was a bull that was evaluated because of bilateral testicular damage because of previous problems with the contralateral testicle and, in retrospect, was not a good candidate for surgery because of the poor prognosis for future fertility. The bull was hemicastrated at the owner’s request because of the perception of the bull’s value.

Scrotal or testicular abnormalities may result in reduced semen quality, reduced semen production, and swelling of the scrotum or spermatic cords. Rapid initiation of treatment is necessary to reduce permanent damage to the affected testicle and to prevent damage to the contralateral testicle because of regional inflammation and interference with thermoregulation. Unilateral castration provides an acceptable option for treatment of unilateral disease of the scrotum or its contents. If correction is performed early enough, semen production is expected to return to at least 75% of typical values. Normal semen production returned as early as 22 days after unilateral castration in healthy bulls with no scrotal abnormalities prior to surgery. Our study revealed a return to reproductive function by 6 months after surgery in 13 of 15 bulls for which follow-up data were obtained, indicating that salvage of breeding value is possible after unilateral castration.

Results of examination of semen abnormalities in this study indicated there is a general increase in semen abnormalities near the time of surgery, which continues for approximately 1 to 2 months after surgery. There is then a marked increase in the number of normal spermatozoa, and the number of normal spermatozoa returns to approximately the same value as before surgery. This is an expected consequence of the increase in scrotal temperature caused by inflammation and degeneration of the affected testicle. Increased temperature will also affect the normal contralateral testicle, causing the production of abnormal spermatozoa. This delay of 1 to 2 months accounts for the transport time and the time of spermatozoa production in the testicle itself. In those bulls with available semen data, spermatozoa motility, the percentage of spermatozoa with normal morphologic characteristics, and the percentage of intact acrosomes were similar before and after surgery and were at values acceptable to the artificial insemination industry. It was interesting that 3 bulls returned to levels of spermatozoa production after surgery that were higher than those before surgery. It is presumed that this was because of coincidental maturation of the bulls with increases in semen production after surgery. Two of these 3 bulls were ≤ 2 years of age. Spermatozoa production is expected to increase with age, and these young bulls
were not likely at peak semen production when hemicastrated.

Duration of disease prior to referral was expected to have an effect on the outcome of the surgery. Unfortunately, follow-up data were not available for those bulls with the longest duration of disease prior to referral. In general, 4 of 5 pasture bulls and 9 of 10 stud bulls were able to return to productive use. This retrospective study was limited in follow-up data for many bulls. Bulls with poor outcomes may have been lost to follow-up and may have biased the follow-up data.

Physical and ultrasonographic examination of bulls with scrotal swelling will often provide a diagnosis and indicate the need for surgery. Palpable heat or swelling in the scrotum indicates a severe abnormality such as orchitis or periortchitis, which may require surgery to remove the affected testicle. Small or soft testicles may indicate testicular degeneration, for which surgery may not be helpful. Epididymitis can be differentiated from testicular abnormalities by use of palpation and ultrasonographic examination. Ultrasonographic evaluation of the scrotum can be used to detect peritesticular fluid or fluid pockets in the testicle itself (abscess or degeneration). It is important to note that hyperechoic or hypo-echoic areas in the testicular parenchyma are not in themselves indicative of infertility, as these abnormalities may be present in some clinically normal bulls as well. Abnormalities of the opposite testicle that are inapparent on physical examination may be apparent on ultrasonographic examination, making the prognosis for return to function less favorable. In our study, a bull with lesions in the contralateral testicle was not productive after surgery. This is consistent with results of a study by Heath et al., in which 1 of 2 bulls with bilateral disease failed to return to productive use after surgery.

In our study, 5 beef bulls had inguinal hernias, 4 of which were left-sided. This is consistent with previous results. Inguinal hernias were treated by unilateral castration in the 5 bulls either because of recurrence of a previous hernia or because of the clinician’s choice to minimize the possibility of recurrence of the hernia. Attempts to close the inguinal ring without removal of the affected testicle may lead to strangulation of the testicle or reherniation and possible strangulation of intestine.

Most of the hemicastrations in this study were performed under general anesthesia, most likely because they were performed in a teaching hospital where immobilization of animals is desired for teaching purposes. General anesthesia provides the best exposure to the surgical site and permits thorough exploration of the scrotal sac. However, hemicastration can be performed in a standing animal by use of injectable local anesthesia with or without sedation.

Closure of the scrotal sac varied with surgeon and specific disease. One technique involves closure of the tunica vaginalis, tunica dartos, and skin. Often, the tunica vaginalis is not closed but is ligated with the spermatic cord or amputated. Closure of the tunica dartos was described in only 9 of 21 bulls in our study. Closure of the skin layer can be performed as a complete closure, as a continuous pattern with 1 or 2 interrupted sutures at the ventral aspect, or as a continuous pattern over packing in the scrotum, which exits ventrally from the scrotum. Complete closure of the scrotum following hemicastration may improve hemostasis but does not permit drainage of fluid from the scrotum. This could lead to increased swelling, heat around the remaining testicle, and pain. Incomplete closure can be used to provide drainage of serum and blood from the scrotal sac, which may provide relief of the heat and pressure on the remaining testicle. However, packing may allow migration of bacteria into the wound, causing dehiscence. Incomplete closure is useful for abscessation within the scrotal sac because drainage is provided. In several bulls in this study, complete closure allowed fluid to accumulate and caused increased swelling. More bulls with scrotal packing had incisional problems in this study (40%), compared with those without packing (9%), likely because ventral drainage and packing were used in bulls with preexisting infection or excessive inflammation at the time of surgery. Removal of excess scrotal skin at surgery has been recommended to reduce dead space, but this was not noted in any surgical records in our study.

Postoperative complications can be reduced by the use of cool water hydrotherapy beginning 1 or 2 days after surgery to reduce heat, swelling, and pain in the scrotum. Eleven of the 21 bulls in this study had cool water hydrotherapy after surgery, and a reduction in swelling of the scrotum was noted in all bulls. A secondary complication after surgery is dehiscence of the incision, which may result from preexisting infection, excessive swelling of the scrotum, infection during surgery, or trauma to the scrotum by the bull after surgery. Attempts should be made to prevent these contributing factors, but dehiscence is managed medically until granulation tissue fills the wound.

The most common histopathologic diagnoses in this study were primary diseases of the testicles, indicating that the most common causes of scrotal swelling are testicular in origin. Tubular atrophy is a common sign of testicular degeneration, which may develop because of high scrotal temperature or primary insult to the testicular tissue. Unilateral castration is an effective and useful treatment for unilateral conditions of the scrotum and testis in breeding bulls. Early treatment is recommended to reduce or prevent damage to the contralateral testicle. Return to intended function was obtained in 13 of 15 bulls for which follow-up was available in our study.

References


