Management of urogenital injury and disease in the bull: the scrotum and its contents
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Abstract
Restorative surgery on the reproductive tract can be performed in the practice setting utilizing correctly administered regional analgesia and sedation. With respect to injuries and conditions involving the scrotum and testes, diagnosis and assignment of a valid prognosis can be facilitated by the use of several tools including history, physical examination with an emphasis on palpation, ultrasound, radiology, thermography, and the spermiogram. Surgical techniques and management tips are described.

Keywords: Bull, pudendal nerve block, hemi-castration, scrotum, testicle

Introduction
Surgical and medical management of injuries and other problems of the scrotum and the testes are of value only if they result in restoration of fertility. Additionally, economic considerations are paramount and the ability of our clients to make informed decisions is dependent on both a valid prognosis and a cost effective treatment, which in turn are dependent on effective diagnostics and practical surgical remedies.

Most maladies of the scrotum and its contents can be effectively diagnosed with a good physical examination. Adjunct diagnostic modalities such as ultrasound (+/- Doppler), radiology, and thermography can provide additional information that further refines the diagnosis and more importantly the prognosis. Evaluation of the spermiogram can provide clues with reference to the duration of the insult and potentially the prognosis.

Regional anesthesia techniques that can be utilized for surgeries of the scrotum, as well as penis and prepuce will be described. The combination of sedation and regional anesthesia allows these surgeries to be performed on a standard hydraulic or manual (tilt) table.

Following successful surgical intervention, most bulls can return to service within two to three months. Most of the pathology that is seen is identified either late in the breeding season or after bulls are removed from the herd at the end of breeding season allowing the recovery time to coincide with the bull’s down-time.

Conditions of the scrotum and its contents
Testicular injury
Trauma to the scrotum often results in rupture of the vaginal tunic, which leads to hemorrhage, swelling and permanent damage to the testicle. Diagnosis is typically straightforward. Palpation of the affected and unaffected testes will often lead to the diagnosis, but the use of ultrasound and thermography can aid in establishing the prognosis. Cases that present shortly after injury may not have had significant changes to the spermiogram yet and cryopreservation of semen can be attempted for a short period of time. Studies in which scrotal insulation is applied reveal that spermatogenesis is altered within hours of a thermal insult and abnormally high temperatures as measured by thermography will persist for at least three weeks after a testicle has been removed.

In general the primary goal of management is based on salvaging the function of the contralateral testicle. To this end, the thermoregulatory process of the contralateral testicle must be preserved. Chronic thermal insult results in testicular degeneration, so surgical removal (hemi-castration) should be performed as soon as reasonably possible. However, the administration of antibiotics and a non-steroidal anti-inflammatory drug (NSAID) can be initiated as soon as the diagnosis is made, while awaiting surgery. Cold water hydrotherapy may also be helpful in decreasing damage to contralateral testicle while the bull awaits surgery and during the post surgical recovery period.
Inguinal hernia

Inguinal hernias have been classified in the veterinary literature as either direct or indirect. This designation appears to have been borrowed from human literature. In the human classification an indirect hernia is one that passes through the inguinal ring and is considered to be a congenital defect.\(^6,7\) The direct hernia is a muscular wall defect and is usually acquired. Additionally, the hernia’s relationship to the inferior epigastric artery was the actual basis for classification.\(^8\) All inguinal hernias in the bull pass through the inguinal ring,\(^9\) (even those in which the ring is torn and enlarged) with the main differentiation appearing to be whether or not the hernia is contained within the parietal vaginal tunic (indirect hernia) or not (direct hernia). Because direct herniation involves a tear in the vaginal tunic, intestinal strangulation and incarceration are more likely and thus require immediate surgical correction as soon as the patient is stable for surgery. To further complicate our current classification, some direct hernias extend down into the scrotum and are sometimes termed scrotal hernias. Because indirect herniation is contained within the vaginal tunic and the vast majority do not have incarcerated or strangulated bowel, surgical correction can be considered elective. It might be appropriate to consider a classification change that would either be based on severity or be more consistent from a terminology standpoint.

From a diagnostic standpoint these cases will present in one of two ways; the colicky, metabolically compromised, and painful bull with strangulated, incarcerated bowel and an obvious swollen scrotum or the bull that appears clinically normal except for a swelling in the neck of the scrotum (the “hourglass” appearance).

Examination should include palpation and ultrasound of the scrotal contents along with rectal palpation of the inguinal rings. Ultrasound is especially valuable to determine the presence of bowel.

In general, both types of herniations occur primarily in mature bulls, most often on the left side and are acquired. Etiologies range from fighting to fence jumping. The most likely predisposing factor is the over-fit bull that has subsequently lost weight and now has a more assessable inguinal canal. Speculation as to why left-sided hernias are more common centers around the bull’s predisposition to lying sternal-right. In the case of the typical, non-life-threatening herniation, the primary problem is disruption of thermoregulation of the testes. As described later, there are surgical options that allow for the preservation of both testicles. When there is incarceration/strangulation of the bowel preparations should be made for the administration of intravenous fluids and emergency surgery including the likelihood of intestinal resection and possible hemi-castration, and continued post-surgical care.
Hydrocele, varicocele, and scrotal fluid accumulation

A hydrocele is basically a fluid accumulation in the scrotum and virtually always within the parietal vaginal tunic. Because there is communication between the peritoneal cavity and the vaginal tunic, fluid can accumulate anytime there is increased abdominal fluid (ascites). Various conditions can cause ascites and in turn scrotal fluid accumulations. A common example is hypoalbuminemia due to intestinal parasitism or anemia due to *Eperythrozoon* infection. In these cases the fluid is generalized (entire scrotum is enlarged). Also, *Setaria* or potentially the fibrosis suspected to be caused by their presence, has also been incriminated as a cause of hydroceles. Injury is also a possible etiology. In any case the presence of fluid has a detrimental effect on the testes, due to loss of thermoregulatory function, and thus fertility. Fertility can be restored if corrected early before testicular degeneration occurs. A varicocele is fluid or swelling within the pampiniform plexus and is usually associated with poor fertility in older bulls. Varioceles are usually found when performing an ultrasound scan to investigate the declining fertility of an older bull.

Treatment of scrotal fluid accumulation due to ascites is aimed at correcting the initiating cause. For the hydrocele that is unilateral and chronic, hemi-castration of the affected testicle is a viable option.

Anesthetic considerations

Although there is a strong argument that a majority of the surgical procedures aimed at restoring reproductive function in the bull are best performed utilizing general anesthesia, utilization of regional nerve blocks and sedation, coupled with good restraint is both adequate and more economic.

A suggested protocol that should be followed is to stall the bull, withholding all feed for 48 hours and water for at least 12 hours. Then in preparation for surgery the bull is sedated. The dosage is dependent on the bull’s behavior, but typically 10 mg of acepromazine IV (tail vein) is adequate. The goal is for the bull to be relaxed, but he must remain standing. Two regional nerve blocks will be described, the pudendal and the sacral paravertebral. The authors utilize the pudendal for bulls and the sacral paravertebral more for cows. The bull now slightly sedated and in a chute or location from which he can be easily moved to the table is prepared for the pudendal block.

Pudendal nerve block

To perform this block, first prepare the area of the ischiorectal fossa. Then by rectal palpation locate the lesser sciatic foramen which is located wrist deep and lateral. The lesser sciatic foramen is formed by the sacrosciatic ligament dorsally and the lesser sciatic notch ventrally. The pudendal nerve is located very close to this foramen. Following the intradermal injection of a small amount of lidocaine, a 14-gauge needle is placed through the skin at the ischiorectal fossa. A 6 to 8 inch 18-gauge needle then is passed through the 14-gauge needle and with guidance from a hand within the rectum the tip of the needle is placed in close approximation to the internal pudendal nerve. Then 20 to 75 cc of lidocaine is injected. Since these are paired nerves, swap hands and sides and repeat the procedure on the contralateral nerve.
Effectiveness of this block can be evaluated by “pinching” the tail of the epididymis. The normal involuntary reaction is a lifting of the testicle. Inability to lift or retract the testicle signifies adequate analgesia. Since each testicle receives independent innervation both epididymides are tested.

Sacral paravertebral nerve block

Blocking the pudendal, middle hemorrhoidal, and caudal hemorrhoidal nerves is easily facilitated by blocking S-3, S-4, and S-5 as they branch off the spinal cord, the important anatomical landmarks are the foraminae that are located lateral to the dorsal midline. Because lateral movement increases the difficulty, squeeze chute restraint and tranquilization is recommended. A caudal epidural may be beneficial in the flighty or hypersensitive individual as well. Clip and perform a surgical preparation of the skin over the dorsal sacrum. The paired S-5 foramina are 1-2 cm lateral to the sacral-coccygeal joint (the most cranial of the joints movable when the tail is raised and lowered). The S-4 foramina are about 3-4 cm cranial, but more lateral and the S-3 foramina are an additional 3-4 cm cranial. A stab incision dorsal to each foramen will facilitate the introduction a 5-7 cm, 18 gauge needle. These foramina can be palpated rectally and a finger placed in or over the ring both identifies the structure and assures the correct placement of the needle. When the osseous ring is entered inject 2-3 cc of lidocaine or an alcohol/lidocaine mixture if the purpose of the block is to manage tenesmus following such conditions as rectal prolapse or a chronic vaginocervical prolapse. An effective mixture is 1 cc of 2% lidocaine and 2 cc of 95% ethyl alcohol. This mixture should effectively decrease tenesmus, while maintaining tail viability.
**Hemi-castration**

The technique for hemi- or unilateral castration is straightforward and can definitely be performed in the bull with a combination of sedation, good restraint and regional or local anesthesia. The bull should be fasted for 48 hours and water withheld overnight. Antibiotics are begun the day before surgery and continued for at least five days after surgery. A pudendal nerve block can be performed on the ipsilateral side to the affected testicle or a local anesthetic can be injected into the neck of the scrotum, infiltrating the spermatic cord. The surgical area is prepared for aseptic surgery as the scrotum will be closed. An elliptical incision the length of the testicle, taking care to leave the parietal tunic intact, will provide excellent exposure and serve to minimize dead space following removal of the testicle and closure. After blunt dissection to free the testicle the parietal tunic is excised. This exposes the testicle and the spermatic cord. The cremaster muscle is transected and the spermatic artery and vein are double ligated with an absorbable suture (#0 or larger). Remove most of the parietal tunic, leaving enough to suture over the cord stump. The cord can be closed with #0 absorbable suture as well. Close the dead space and place a Penrose drain that exits at the most distal aspect of the scrotum, two to three cm from the distal end of the incision. The incision can then be closed with #2 non-absorbable suture material utilizing a suture pattern of the surgeon’s choice. The authors then suggest wrapping the scrotum containing the remaining testicle with elastic tape.
This is especially useful if the bull will be stalled for a few days and exercise is limited. The wrap is removed in two days and the Penrose drain is removed the following day, but can be left until day four after surgery. As stated previously hydrotherapy can be utilized if significant swelling occurs, but two days with the aforementioned bandage and a return to the pasture seems to be the best way to avoid swelling.

**Inguinal hernia repair**

The two approaches to the repair of an inguinal hernia include a standing, flank approach utilizing regional anesthesia and an inguinal approach in which the bull is placed in lateral recumbency-affected side up.9 The standing, flank approach is the definite choice of the authors if the scrotal contents can be moved during palpation of the scrotum and testes. Additionally, in the case of an elective repair of an indirect inguinal hernia, some hernias will, following a 48 hour fast, become less evident externally as abdominal contents exert less pressure. However some hernias cannot be repaired via this approach and an inguinal approach has to be used.

For a standing flank approach, the ipsilateral paralumbar fossa is prepared for surgery. An inverted-L local or paralumbar block can be employed. After entering the abdomen, the inguinal ring is identified, the herniated tissue grasped, and with traction applied, the hernia is reduced. Adhesions to the parietal vaginal tunic or from fibrosis due to the tearing of the tunic complicate this and may necessitate an inguinal approach. However, if the hernia can be reduced, the inguinal ring closed with a blindly placed suture. One of the authors (Hopper) utilizes a continuous “blind” suture pattern in which a length of suture material (#2 chromic catgut) is passed through a needle, doubled, and a knot tied about 12-15 cm from the end (tail). After the first pass through the tissue, the needle is passed back through and between the doubled suture, pulled tight (cinched), and continued. When the end of the ring is reached, go back the other direction and then tie to the “tail”. Thus, only one knot is needed. Care to avoid regional vasculature is of obvious importance. The flank is closed in a routine manner.

The inguinal approach for inguinal hernia repair necessitates the use of general anesthesia. The bull must be in lateral recumbency with the affected side up. The upper rear leg must be raised and the inguinal area prepared. A 20-25cm incision is made over the inguinal ring and continuing through the subcutaneous tissues approach, identify, and expose the spermatic cord. In the case of the direct hernia, you will have likely already encountered herniated bowel and identification of non-viable bowel and resection/anastomosis will be the next step. If the parietal tunic is intact, the spermatic cord guides blunt dissection toward the ring. The tunic is then incised to facilitate the examination of the hernia contents and specifically the presence of adhesions. Blunt dissection to separate the adhesions is performed only after pre-placement of one or more ligatures. Reduce the hernia contents and then identify and remove the inguinal fat pad if present. Closure of the ring is a two step process.9 First, using #4 non-absorbable suture and an atraumatic “hernia” needle take a “bite” 2 cm from the medial aspect of the ring, going on one side of the spermatic cord engaging the internal abdominal oblique muscle and then returning on the same side go back through close to the original “bite” (do not tie). Then repeat on the other side of the cord, making sure that the point engaged on the external abdominal oblique is at least 3 cm from the first. Tighten and tie both at the same time. Pulling the muscle over adds stability to the closure and “protects” the cord. The ring is then closed with an overlapping pattern suture pattern again utilizing non-absorbable suture. Close the ring down to the point where two fingers can still be placed adjacent to the cord. After closing the incision that was made in the parietal tunic as well as the dead space the skin is then closed with a Ford inter-locking pattern.9

Regardless which procedure is employed, antibiotics are continued for five more days and as in the case of the hemi-castration return to a small lot from a stall provides the exercise that will help to minimize post-operative swelling.

**Conclusion**

Surgical procedures that can potentially restore the fertility of the bull should increase in demand with the recent increases in cattle prices and specifically the sale prices at auction for elite breeding bull
prospects. A careful diagnostic approach that assures a realistic prognosis is essential for producers making an economic decision regarding an injured bull. Use of regional anesthetics instead of general anesthesia, when possible and acceptable can also make many of these restorative surgeries more economical.

References

(Editor’s note: The photographs in this paper appear in color in the online edition of Clinical Theriogenology.)