Theriogenology Question of the Month

In cooperation with

History

A 2.5-year-old 680-kg (1,496-lb) Hereford bull was referred to the J. T. Vaughan Large Animal Teaching Hospital at the Auburn University College of Veterinary Medicine for evaluation of a large scrotum. The bull was used as a herd sire and had been housed in a pasture with cows for the preceding 2 months. The owner noticed the bull's large scrotum 3 days prior to admission at the teaching hospital. On the day prior to admission, the bull was examined by a referring veterinarian, who found a large fluctuant area on the left side of the scrotal neck. Aspiration of that fluctuant area yielded dark brown fluid.

At the time of admission to the teaching hospital, the bull was bright, alert, and responsive. Heart rate, respiratory rate, and rectal temperature were within reference limits. The scrotal neck was large and asymmetric as a result of distension above the left testis **(Figure 1)**. Palpation of the scrotum revealed that the left testis did not move freely within the scrotum and that the testis was soft and less turgid than expected for a normal testis. Contents of the scrotal neck resisted deformation and were the consistency of firm dough, which prevented identification of the spermatic cord. Manual manipulation of the left side of the scrotal neck caused signs of discomfort to the bull. The right testis was freely movable within the scrotum but was also palpably less turgid than a normal testis. Ultrasonographic examination of the left side of the scrotum revealed multiple circular and tubular structures with peristaltic movement, which was consistent with small intestines. Transrectal palpation revealed several loops of bowel entering the large left inguinal ring. Clinical examination, ultrasonographic, and transrectal palpation findings were diagnostic for inguinal herniation of the small bowel.

After examinations were completed, the bull was placed in a stall. The bull appeared to be uncomfortable and frequently assumed an abnormal stance in which he stretched the lumbar vertebral column ventrally and abducted the left hind limb.

Question

What are the types of inguinal herniation in bulls? ***Please turn the page.***

Figure 1—Photograph of the rear of a 2.5-year-old 680-kg (1,496-lb) Hereford bull examined because of a large scrotum.

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Answer

Inguinal hernia in bulls can occur as a result of abdominal viscera passing through the inguinal ring (the viscera enters the vaginal cavity between the parietal and visceral vaginal tunics [indirect inguinal hernia]) or by traumatic rupture of the abdominal musculature adjacent to the inguinal ring (resulting in visceral herniation external to the vaginal tunics [direct hernia]).

Results

The bull was sedated and placed in right lateral recumbency on a hydraulic tilt table. Anesthesia was induced, and the left hind limb was abducted at a 45° angle. A 20-cm incision was made in the skin over the left inguinal ring. The subcutaneous tissue and tunica dartos were incised, and a combination of blunt and sharp dissection was used to expose the parietal vaginal tunic. The parietal vaginal tunic was incised to open the vaginal cavity, which contained approximately 2 m of herniated jejunum and a portion of the omentum **(Figure 2)**. There was a large, well-organized blood clot located ventral to the loops of jejunum at the dorsal pole of the left testis. There were numerous fibrinous adhesions between the visceral vaginal tunic of the testis and intestines and between the parietal and visceral vaginal tunics. Despite these adhesions, the intestines appeared healthy, had physiologically normal peristalsis, and apparently were viable. Adhesions were manually disrupted to free the small intestines, which were then repulsed (along with the herniated section of omentum) through the inguinal ring into the abdomen.

Figure 2—Photograph obtained during surgery on the bull of Figure 1. The skin and parietal vaginal tunica have been incised to expose the hernia contents, which consist of approximately 2 m of herniated jejunum and a portion of the omentum.

Because the extensive fibrous adhesions between the parietal and common vaginal tunics of the left testis would disrupt scrotal thermoregulation, a left unilateral castration was performed prior to closing of the inguinal ring. The spermatic cord was transfixed and ligated with No. 1 chromic catgut suture. The inguinal ring was then closed with No. 3 nylon suture in a modified Mayo mattress pattern. Excess scrotal skin and tunic were excised, and the subcutaneous tissue was closed by use of No. 1 chromic catgut suture in a simple continuous pattern. Scrotal skin was closed with No. 3 nylon suture in a Ford interlocking suture pattern. After the surgery was completed, the bull recovered from anesthesia without incident.

Penicillin G procaine was administered after surgery (22,000 U/kg [10,000 U/lb], IM, for 5 days). Mild postoperative ileus developed 24 hours after surgery, but it resolved following IV administration of a constant rate infusion of 2% lidocaine for 48 hours. The bull had no further complications and was discharged to the owner 1 week after surgery.

Discussion

Inguinal herniation occurs in a variety of ways. A direct hernia occurs as a result of a defect in the abdominal musculature. When abdominal contents pass through the inguinal ring without disruption of the parietal vaginal tunic, the herniated contents are contained within the space between the parietal and vaginal tunics. These hernias, which do not result in disruption of the abdominal musculature or peritoneum, are referred to as indirect inguinal hernias. In this type of herniation, strangulation of viscera contained within the hernia is less likely to occur than in herniation involving traumatic disruption of the abdominal wall. Diagnosis of indirect inguinal hernia is often delayed because the animal does not display signs of distress or pain, and the condition is often long-standing by the time of examination.

In cases of indirect inguinal herniation, the scrotum generally has a characteristic hourglass shape because the vaginal cavity in bulls is narrower immediately proximal to the dorsal pole of the testis, which restricts herniated viscera to the scrotal neck and prevents migration into the distal portion of the scrotum. For both types of inguinal hernias, testicular thermoregulation is compromised for the affected testis and potentially for the testis contralateral to the lesion, which causes disruption of spermatogenesis.[1–3] Indirect inguinal herniation reportedly occurs more commonly through the left inguinal ring.[2] This has been postulated to be attributable to the tenden-

cy for bulls to lie in right sternal recumbency. When in this position, the rumen pushes more weight onto the left side of the body than the right side of the body, and abduction of the left hind limb potentially opens the left inguinal ring.

Indirect inguinal herniation is most commonly seen in bulls that were overconditioned as yearlings. This may occur because overconditioned young bulls deposit excess retroperitoneal fat in the area of the scrotal neck, which potentially enlarges the inguinal rings. When the excess weight is lost, the larger inguinal ring may allow viscera to pass through the ring.[1,2]

Omentum, jejunum, or jejunoileum is the viscera that most commonly herniates through the inguinal rings.[3,4] Diagnosis can be made by identifying the bowel passing through an inguinal ring during transrectal palpation and via percutaneous palpation of scrotal contents. Ultrasonographic evaluation of scrotal contents is also useful in attaining a diagnosis. When the omentum is herniated, it can be seen ultrasonographically as a heterogeneous, hyperechoic structure adjacent to the uniformly homogenous echogenic pattern of the testes. Herniated small bowel will appear as dilated loops containing flocculent material within the lumen. If the condition is long-standing, the testis on the affected side will often undergo some degree of degeneration secondary to the disruption of scrotal thermoregulation. In such cases, the affected testis may be smaller than the contralateral testis, and echogenicity of the affected testis will be increased, compared with that of the contralateral testis.[3]

An inguinal hernia that occurs as a result of a defect in the abdominal musculature, which is usually attributable to fighting or jumping over a fence, or through a tear in the vaginal tunic is referred to as a direct hernia. In the case of traumatic herniation, there is a greater chance of strangulation of incarcerated bowel that potentially will result in an emergency situation. Bulls with a direct hernia often have signs of pain, frequently have signs of abdominal discomfort, and may be metabolically compromised as a result of ischemia of the bowel. There is no predilection for the side of the body or characteristic shape associated with direct hernias. Severity of the condition depends on the duration and degree of ischemic damage, but few bulls with a direct hernia survive more than 4 to 6 days after injury. Because adhesions prevent manual reduction of the herniated intestine, and vascular compromise following strangulation is common, surgical repair via an inguinal approach in an anesthetized animal is the only treatment option. Intestinal compromise requiring resection and anastomosis may occur following direct or indirect herniation; however, it is more likely in animals with direct herniation because of disruption of anatomic structures.

On the basis of clinical examination, ultrasonographic, and transrectal palpation findings, an indirect inguinal hernia was diagnosed in the bull of the present report. Surgical correction to reposition the herniated contents within the abdomen followed by suturing of the inguinal ring to prevent reherniation and further disruption of testicular thermoregulation was believed to provide the best opportunity to preserve fertility.

Surgical repair of an indirect inguinal hernia may be accomplished through a flank incision for a bull in a standing position or through an inguinal incision for a bull positioned in lateral recumbency. The standing flank approach has the advantage of not requiring general anesthesia of the bull, but it is disadvantageous in that surgeons are restricted in their ability to break down adhesions or achieve anatomic alignment when reconstructing an enlarged inguinal ring. Although the inguinal approach requires general anesthesia of the bull, it provides the opportunity for visual inspection of herniated contents and is preferred when there is a likelihood of adhesion formation.

Unilateral castration may be necessary when the testis is irreparably damaged or there are extensive adhesions between the vaginal tunics that will impede testicular thermoregulation. The testicular parenchyma must be maintained at 4° to 7°C below core body temperature for physiologically normal spermatogenesis.[5] Intricate relationships between the arterial and venous vasculature allow heat from arterial blood supplying the testes to be transferred to the venous vasculature before the blood reaches the testes. This countercurrent heat exchange mechanism, coupled with the actions of the tunica dartos and cremaster muscles, is essential to maintain testicular thermoregulation within a narrow temperature range. Intrascrotal adhesions can prevent mobility of a testis within the vaginal cavity, which limits the ability of the tunica dartos and cremaster muscles to effectively raise or lower the testis within the vaginal tunics in response to thermoregulatory cues from scrotal sensory nerves.[5] The pampiniform plexus plays a vital role in thermoregulation of the testes. Inflammation that generates excessive heat, or adhesion formation that interferes with testicular mobility in response to contractions of the tunica dartos and cremaster muscles, will impede thermoregulation and result in substantial disruption of spermatogenesis. Excess heat from the affected testis may potentially be transferred to the contralateral testis, which would result in disruption of thermoregulation in both testes. If the condition is not corrected in a timely manner, damage to the contralateral testis caused by loss of thermoregulation may become irreversible.[5]

Fertility following unilateral castration can be good if the contralateral testis has not sustained permanent heat-induced damage. If the testis remaining after unilateral castration is healthy, it will hypertrophy and may be capable of up to 75% of the original spermatozoa-producing capacity of the paired testes.[2] Before unilateral castration is performed, the contralateral testis should be evaluated by use of palpation and ultrasonography.[6]

Bulls for which unilateral castration is indicated and that have a healthy remaining testis can be used for breeding. After an adequate recuperation time, which allows for a complete spermatogenic cycle following resolution of the thermoregulation disruption (≥ 60 days), the remaining testis can produce a sufficient number of morphologically normal, progressively motile spermatozoa to impregnate cows. However, such bulls cannot be classified as satisfactory potential breeders for the Society for Theriogenology breeding soundness examination because of the fact they only have 1 testis.

The prognosis is guarded for bulls that have strangulated viscera, and these patients will require more extensive medical management during recovery. Regardless of the type of hernia (direct or indirect inguinal), there is a chance of recurrence.[7]

Outcome

The bull was evaluated by the referring veterinarian 2 months after the surgical repair and was found to have adequate semen quality with 90% progressively motile spermatozoa and < 5% abnormal spermatozoa. The producer reported that the bull had good libido. However, no pregnancy data were available for the bull at that time.

References

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Correction: Agonistic behavior and environmental enrichment of cats communally housed in a shelter

In the report "Agonistic behavior and environmental enrichment of cats communally housed in a shelter" (*J Am Vet Med Assoc* 2011;239:796–802), the name of the first author is incorrect. The individual's name is Leticia M.S. Dantas.