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Rumen Cannulation: Procedure and Use of a Cannulated Bovine

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Healthy rumen flora is important for obtaining a high level of production from a ruminant. Evaluation of rumen microflora can help determine the status of the microbial population. If rumen microbial populations are low or are inappropriate for the diet being consumed, replacement or addition of ruminal microbes can be performed by transfaunation of rumen content from a donor animal. Several methods for obtaining transfaunate are described in the literature. Using a rumen donor by rumen cannulation can provide long-term access to rumen fluid with minimal labor, time, and expense invested.

Ideal characteristics of a rumen transfaunate donor

A donor animal should have a good, quiet demeanor and be free of disease or physical maladies that could result in an abnormally shortened life span. Testing for the presence of persistent infection with bovine viral diarrhea virus and bovine leukemia virus should serve as a baseline for donor selection.

An animal with a large paralumbar fossa (PLF) is preferred, because the cannula may rub on the rib or transverse processes if the PLF is too small. A donor animal for dairy cattle should be consuming the lactation ration, because lactating cows are most commonly afflicted with gastrointestinal disturbances. In a feedlot setting, the most beneficial animal is one consuming an intermediate ration. This allows for the transfaunate to contain microbes necessary to metabolize a ration with moderate carbohydrate

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composition. A gradual work-up of the ration's carbohydrate concentration is still needed anytime an animal has been off feed for an extended period of time, or if the rumen has been evacuated as in a grain overload situation.

Preparation of the rumen cannula before insertion

Several different substrates can be used in the manufacturing of gastrointestinal cannulae. Both rigid and flexible rumen cannulae are commercially available for use in the bovine. The use of a flexible rumen cannula is described within this discussion. Both types of cannulae have advantages, but the flexible cannula allows for growth in the individual with minimal tissue trauma, and is the authors' preference.

Cannulas of different sizes are available and care should be taken to match donor size with the size of cannula to prevent rubbing or loss of the cannula. The diameter of the center of the cannula should be measured and then the cannula should be submerged in hot water until pliable. Remove the cannula from the hot water and immediately reach through the center hole and pull the inside flange into the lumen of the cannula. Do not completely invert the cannula. Return it to a hot water and antiseptic solution until the donor is prepared.

Although actual insertion may vary, surgical approach and preparation do not vary for different brands of flexible cannulae. Within the context of this discussion, preparation and usage of the Bar Diamond (Bar Diamond, Parma, Indiana) cannula is considered.

Presurgical preparation of the donor

The donor should be held off feed for at least 24 hours, and off water for 12 hours before surgery. This results in less rumen fill, making the rumen wall more flaccid, which allows for easier exteriorization. Rumen contractions are also decreased, resulting in less movement of the rumen during surgery.

The surgery can easily be performed with the animal standing with adequate chute restraint. Right lateral recumbancy is an alternative approach, but does increase the likelihood of peritoneal contamination and increases the difficulty in proper cannula placement. The left PLF is clipped dorsally from the transverse processes, ventrally to the flank fold, caudal to the tuber coxae, and cranially to the twelfth rib. The clipped area is then prepared with a surgical scrub and regional anesthesia is administered with a paravertebral, inverted L, or line block using 2% lidocaine solution. Sedation of the patient is generally not required and necessity may indicate an unsuitable donor demeanor. One dose of broad-spectrum antibiotics is recommended presurgery to reduce postsurgical pyrexia and infection [1].

Surgical technique

Location of the fistula is imperative to prevent unnecessary rubbing and skin erosion by the cannula. The appropriate area for the fistula is in the dorsal half of the left PLF, approximately 4 to 5 in ventral to the transverse processes and centered between the thirteenth rib and tuber coxae. Appropriate positioning allows for the outer ring to sit within the confines of the PLF, transverse processes, rib, and the tuber coxae.

A circular area of the skin approximately 0.5 in smaller in diameter than the inside diameter of the cannula is excised [2]. It is helpful to use a template and mark the area before beginning the excision, because natural tension of the skin distorts the area and results in an excessively large area of skin being removed (Fig. 1). This in turn causes the rumenostomy site to be excessively large for the chosen cannula and allows for a poor seal to be formed between the cannula and the rumen wall, preventing maintenance of an anaerobic rumen environment.

Gridding of the external abdominal oblique, internal abdominal oblique, and transverse abdominus muscles reveals the peritoneum. Gridding is advised as opposed to incision to aid in securing the cannula in the abdominal wall [2]. Once the peritoneum is exposed, it should be punctured, avoiding the underlying rumen. The peritoneum is then manually gridded to a size equal to that of the opening in the musculature. There is no need to suture the peritoneum to the external abdominal oblique.

The rumen should be grasped with sterile 4 × 4 gauze pads, and a pair of Allis tissue forceps is used to exteriorize the wall through the laparotomy site. Horizontal mattress sutures are placed at the dorsal, ventral, cranial, and caudal margins of the incision to secure the rumen to the body wall (Fig. 2). Size one chromic catgut is used and can be removed following completion of the surgery. These stay sutures are placed partial thickness through the rumen wall to prevent possible contamination of the surgery site [2]. The rumen wall is then exteriorized to encompass an area

Fig. 1. The template used to mark the area of skin to be excised should be approximately 0.05 in smaller in diameter than the diameter of the inner ring of the cannula.

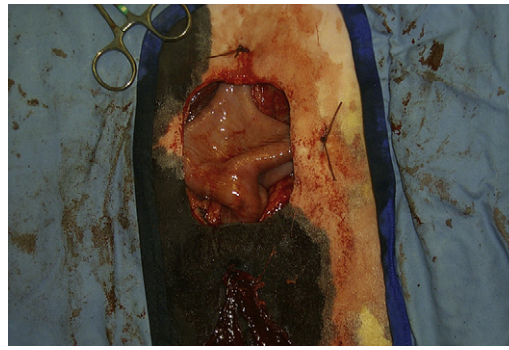

Fig. 2. Stay sutures have been placed to stabilize the rumen before pexy at 12-, 3-, 6-, and 9-o'clock positions.

approximately equal to the inner circumference of the cannula to allow for complete circumferential suture placement without stretching the rumen wall.

The ventral half of the exposed rumen is then incised, and sutured to skin using a continuous everting pattern with size #2 absorbable suture, starting at the cranial aspect of the skin incision (9 o'clock) and continuing ventrally (6 o'clock) to the caudal aspect (3 o'clock; Fig. 3). The dorsal half of the rumen is then incised dorsally and secured to the skin in an everting pattern consistent with that done for the ventral portion. The stay sutures are then removed.

Once the rumen has been sutured to the skin, the cannula is removed from the hot water bath. Water is used to lubricate the cannula before insertion. The cannula is inserted into the rumen by advancing the conical flange through the fistula (Fig. 4), reaching into the center of the cannula, and then everting the flange into the lumen of the rumen (Fig. 5). This secures the cannula in place. The final step is to insert the stopper into the cannula,

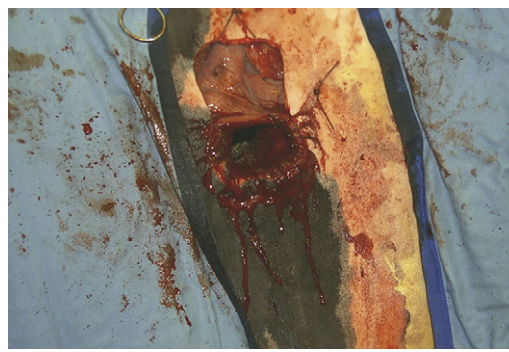

Fig. 3. An everting suture pattern is used to attach the ventral half of the rumen to the skin, thereby reducing potential of peritoneal cavity contamination.

Fig. 4. The inner flange is being pushed out through the center of the cannula into the lumen of the rumen.

which is easiest to do if the stopper and center of the cannula are first lubricated with mineral oil.

Postsurgical care

The surgical site and the surface of the cannula's outer rim next to the skin should be cleaned daily for 5 to 7 days with a dilute antiseptic solution. Approximately 10 days postsurgery, remove the cannula by reaching through the center of the cannula and pulling the inner flange into the center. A necrotic ring of rumen tissue and any remaining suture material should be removed from the edge of the fistula. Once the wound is cleaned, the cannula is replaced. Bimonthly cleaning after that is sufficient. The wound should be protected from flies, and a broad-spectrum antibiotic should be administered for 7 days following surgery. Postoperative analgesics could be used if the animal seems uncomfortable. If no contamination occurred during surgery, then postoperative antibiotics are not necessary [1]. One study found that giving one dose of antibiotics before an exploratory

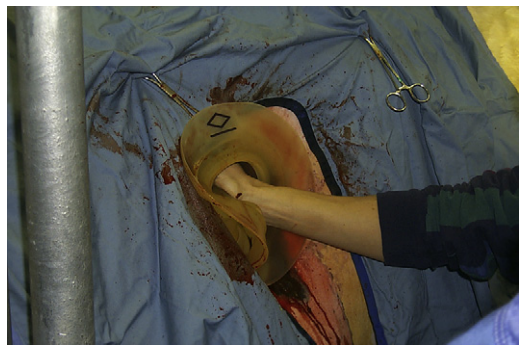

Fig. 5. Once inverted, the inner flange secures the cannula into the rumen.

rumenotomy was as effective for preventing abscessation and postoperative pyrexia as giving an antibiotic presurgery and following-up with a 7-day course of postoperative antibiotics [1].

Transfaunation

Transfaunation is the removal of ruminal fluid and microbes from one animal, and the transfer of that material to a different animal. The primary cause of abnormal ruminal flora should always be indentified and corrected before transfaunation. The rumen environment must be receptive and conducive to microbial life before introduction of new microbes. A rumenotomy and evacuation of ruminal contents may be necessary in some cases, whereas high doses of oral antibiotics may suffice to remove abnormal microbes in others. An appropriate amount of rumen fill is necessary to stimulate motility if evacuation is performed; therefore, feedstuffs must be placed into the rumen along with the transfaunate. Alfalfa pellets, soaked with water to make a mash, are easily administered by an oral-esophageal tube and provide nutrients for microbes. Long-stem hay may also be introduced through the rumenostomy site before closure.

One quart (approximately 1 L) of rumen fluid is adequate to transfaunate ruminating calves, and a minimum of three quarts (approximately 3 L) should be administered to adult cattle [3]. Rumen fluid for transfaunation purposes can be obtained from an abattoir or from a cannulated animal. Transfaunate is best when used immediately following collection, but contains viable organisms for up to 9 hours at room temperature, and for 24 hours if refrigerated [3].

Summary

Rumen cannulation can be done on a healthy animal currently in the herd with minimal expense. The surgery is no more difficult than most other routine surgical procedures performed by bovine practitioners. A cannulated animal provides a long-term, readily available source of rumen content that can be used to transfaunate herd mates that have suffered various digestive upsets.

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