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Rumen Cannulation and Utilization of a Donor Animal

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Abstract

Careful selection of a transfaunate donor animal will improve the outcome of rumen cannula placement and the longevity of the donor animal. A cannulated animal provides an easily accessible source of rumen fluid. Rumen cannulation can be done on an animal currently within the herd with minimal expense.

Résumé

Le sélection avec soin d'un animal donneur va améliorer les chances de succès de l'implantation d'une canule dans le rumen et la longévité de l'animal donneur. La canulation d'un animal facilite l'accès aux liquides du rumen. La canulation du rumen peut être faite chez un animal déjà dans le troupeau à frais modique.

Introduction

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, 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. This article addresses the surgical approach for a rumenostomy and the placement of a rumen cannula.

Characteristics of the Transfaunate Donor

The transfaunate donor animal should have a good disposition and be free of disease or physical maladies that could cause early culling. An animal with a large paralumbar fossa (PLF) is preferred, as the cannula may rub on the rib and or transverse processes if the PLF is too small. A donor animal for dairy cattle should be consuming the lactating cow ration, as lactating cows are most commonly afflicted with gastrointestinal disturbances. In a feedlot setting, the most beneficial animal would be one consuming an intermediate ration. This provides microbes necessary for utilization of a ration with moderate carbohydrate composition.

Cannula Preparation

Several companies manufacture rumen cannulas. Flexible rumen cannulas are manufactured by The Bar Diamond Company[a] and John Morris Scientific[b], and rigid rumen cannulas are available from John Morris Scientific and Macam Rubber.[c] The use of a flexible cannula[a] will be described within this article. Although insertion would vary, the surgical approach would be the same with another company's product. 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 submerged in hot water until pliable. Remove from the hot water, and while still hot and pliable, reach through the center hole and pull the inside flange into the lumen of the cannula. Do not completely turn the cannula inside out. Return it to a hot water and antiseptic solution until the donor is prepared.

Pre-surgical Procedures

The donor should be held off feed for at least 24 hours, and off water for 12 hours, prior to surgery. This results in less rumen fill, thus making the rumen wall more accessible and flaccid, allowing for easier exteriorization. Rumen contractions will also be decreased, resulting in less movement of the rumen during surgery. The surgery is performed with the animal standing, with adequate restraint provided. The left PLF is clipped dorsally from the transverse processes, ventrally to the flank fold, caudal to the tuber coxae and cranially to the 12th rib. The clipped area is then prepared with a surgical scrub, and regional anesthesia administered with a paravertebral, inverted L or line block using 2% lidocaine solution. Sedation of the patient is generally not required. We typically administer ceftiofur 30 minutes prior to surgery.

Surgical Technique

Location of the fistula is important 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 4-5 inches (10-12 cm) ventral to the transverse processes, and centered between the 13th rib and the tuber coxae. This location should allow room for the outer ring to sit within the PLF, and not rest on the transverse processes, the ribs, or the tuber coxae.

The circular area of skin to be excised should be marked with a permanent marker prior to making an incision. The authors use a cup 0.5 inch (1.3 cm) smaller in diameter than the inside diameter of the cannula as a pattern (Figure 1). An incision is made along the marked area and the circular portion of skin removed (Figure 2). Using a hemostat, the external abdominal oblique, internal abdominal oblique and transverse abdominus muscles should be gridded to expose peritoneum (Figure 3). It is critical that the skin incision is not too large for the selected cannula in order to prevent the cannula from slipping out of the rumen and to maintain an anaerobic rumen environment. Gridding the muscle layers aids in securing the cannula in the abdominal wall, as the muscles contract post-surgery toward their original locale in a circular fashion around the cannula. Once 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 next step is to grasp the rumen with sterile 4X4 gauze pads, and apply a pair of Allis tissue forceps to the rumen wall. Towel clamps may be employed here, but care must be taken to avoid entering the lumen of the rumen, thus potentially contaminating the surgical site. At this point, the rumen should be exteriorized, and secured to the skin by placing horizontal mattress sutures (four total) at the dorsal, ventral, cranial and caudal margins of the incision (Figure 4). Size one (1) chromic catgut is used for these sutures, and can be removed following completion of the surgery. These stay sutures are placed partial thickness through the rumen to prevent possible contamination of the body wall. Once the rumen is secured to the body wall, the rumen wall should be exteriorized to encompass an area approximately equal to the inner circumference of the cannula. This allows 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 continued ventrally (6 o'clock) to the caudal aspect (3 o'clock;

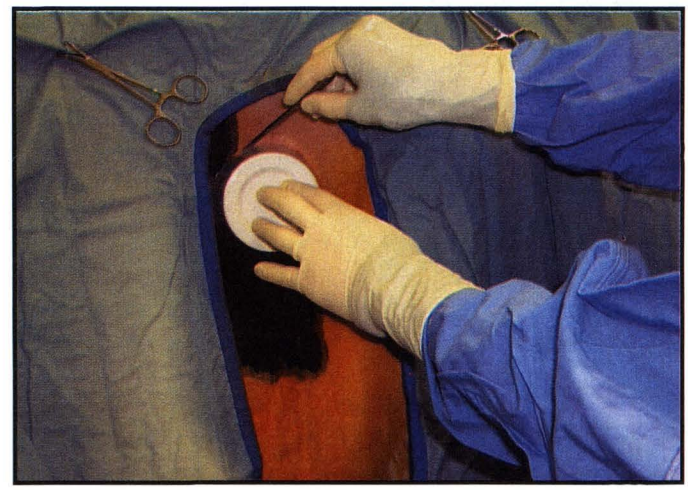

Figure 1. The template used to mark the area of skin to be excised should be approximately .05 inch smaller in diameter than the diameter of the inner ring of the cannula.

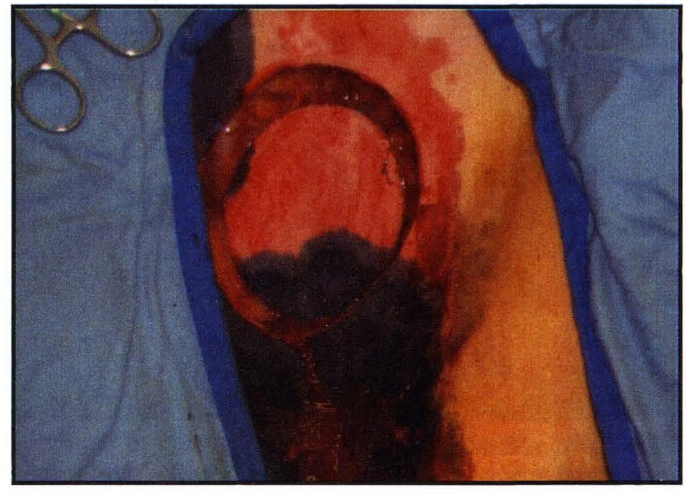

Figure 2. Notice how the incised circular area stretches to create a larger hole than the template. This is the reason for using a template smaller than the actual diameter of the cannula.

Figure 5). 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 (Figure 6). The stay sutures should then be 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 prior to insertion. The cannula is inserted into the rumen by advancing the conical flange through the fistula (Figure 7), reaching into the center of the cannula, and then everting the flange into the lumen of the rumen (Figure 8). This secures the cannula in place (Figure 9). The final step is to insert the stopper into the cannula, which is easier to do if the stopper and center of the cannula are first lubricated with mineral oil.

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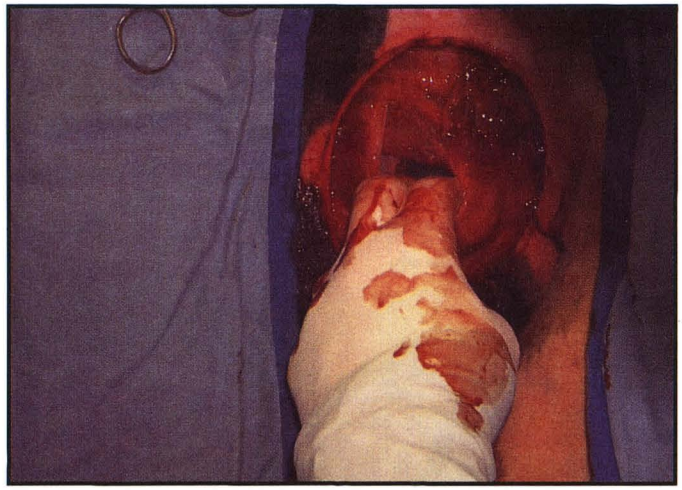

Figure 3. Gridding the abdominal muscles helps to ensure a snug fit of the cannula.

Figure 4. Stay sutures have been placed to stabilize the rumen prior to pexy at 12, 3, 6 and 9 o'clock positions.

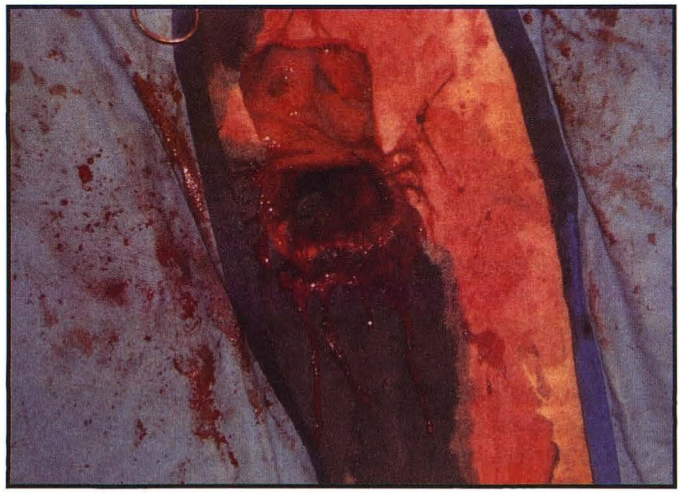

Figure 5. An everting suture pattern has been used to pexy the ventral half of the rumen to the skin first, thereby reducing contamination of the peritoneal cavity.

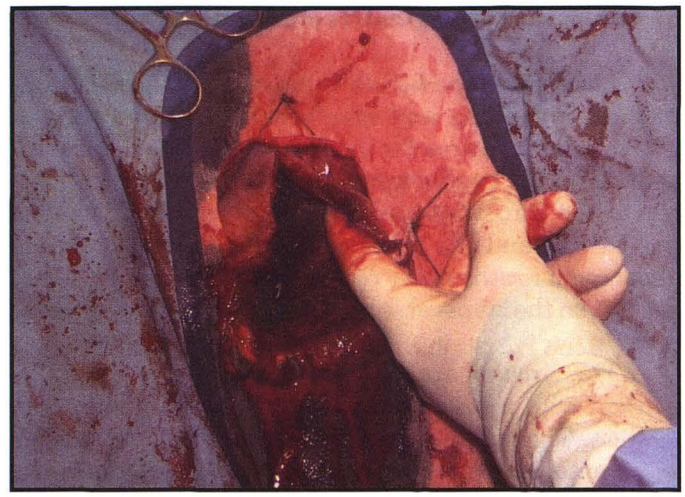

Figure 6. The dorsal half of the rumenostomy site is incised and pexied using an everting pattern.

Figure 7. The inner flange is being pushed out through the center of the cannula into the lumen of the rumen.

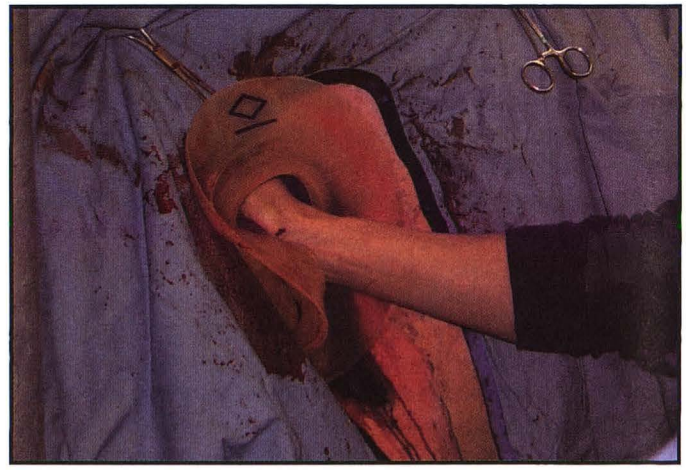

Figure 8. Once inverted, the inner flange will secure the cannula into the rumen.

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Figure 9. A properly placed rumen cannula is snug fitting and does not rub on the tuber coxae, the 13th rib, or the transverse processes of the lumbar vertebra.

Post-surgical Care

The surgical site and the surface of the cannula's outer rim next to the skin should be cleaned daily for five-to-seven days with a dilute antiseptic solution. Approximately 10 days post-surgery, 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 is sufficient after that. The wound should be protected from flies, and a broad spectrum antibiotic should be administered for seven days following surgery. We do not routinely administer postoperative analgesics, but a non-steroidal anti-inflammatory drug, such as flunixin meglumine, could be used if the animal appears uncomfortable.

Transfaunation

Transfaunation is the removal of ruminal fluid and microbes from one animal, and transfer of that material to a different animal. The primary cause of abnormal ruminal flora should always be identified and corrected prior to transfaunation. The rumen environment must be receptive and conducive to microbial life prior to introduction of new microbes. A rumenotomy and evacuation of ruminal contents may be necessary in some cases, while 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 transfaunation. Alfalfa pellets, soaked with water to make a mash, are easily administered via a stomach tube and provide nutrients for microbes to utilize. Long-stem hay may also be introduced through the rumenostomy site prior to closure.

One quart (~1L) of rumen fluid is adequate to transfaunate ruminating calves, and a minimum of three quarts (~3L) should be administered to adult cattle.[2] Transfaunation should be repeated daily until the animal's appetite improves and fecal production returns.

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 nine hours at room temperature, and for 24 hours if refrigerated.[2]

Discussion

There are several surgical approaches to perform a rumenostomy. However, it is not within the scope of this article to compare and contrast each of these methods. The authors chose the described approach because it combines excellent rumen exteriorization with adequate wound contracture, adding to overall surgical success. More than 35 of these surgeries have been performed by the authors over the last five years, and no complications have been encountered to date.

One study found that giving one dose of antibiotics prior to an exploratory rumenotomy was as effective for preventing abscessation and post-operarative pyrexia as giving an antibiotic pre-surgery and following up with a seven-day course of post-operative antibiotics.[3] Because success of the cannulation procedure and longevity of the donor is highly dependent on maintenance of the incision line, it is our opinion that antibiotics should be given pre-operatively, and continued for seven days post-operatively to guard against surgical wound infections. Dehiscence of the rumenostomy site could result in severe peritonitis and death of the animal.

Conclusion

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.

Footnotes

[a]Bar Diamond Company P.O. Box 60 Parma, ID 83660-0060

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[b]John Morris Scientific Pty. Ltd. – Australia
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[c]Macam Rubber Pty. Ltd. – Australia 61-2-9873-8888,
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Abstract

The Relationship Between Disease Occurrence, Feeding Management and Return Over Feed In Ontario Dairy Herds

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Dairy producers of many countries throughout the world are becoming increasingly concerned with global competition. Therefore, it has become important to examine the many management factors that effect profitability of the dairy enterprise. The objective of this research was to examine the relationship between profitability as measured by The Ontario Dairy Herd Improvement Corporation's (DHI) Return Over Feed (ROF) index, and herd characteristics (herd size, TMR use, monensin use, facility type, dry cow therapy, and disease prevention).

Individual dairy producers were identified through Ontario Dairy Herd Improvement's (DHI) Return Over Feed (ROF) and Management Club groups (n=148). Data were recorded by the individual producers on input forms that were collected at monthly meetings. Producers recorded the types and amounts of feeds fed (as fed basis) to their cows and the amount of milk shipped that month. Percent dry matters were taken from provincial averages and herd average cow dry matter intakes were calculated. These intakes were multiplied by fixed market prices to generate feed costs per cow per day. Revenue was calculated based on the Dairy Farmers of Ontario multiple component pricing formula for milk. Monthly producer data was averaged in order to obtain one average entry per producer. Herd management information was generated through a telephone survey of all participants. All individual variables were tested against Return Over Feed in order to distinguish any significant variables ($p<0.2$). All significant variables were then modeled in a backward stepwise linear regression.

In previous studies milk production was determined to have a significant effect on the individual ROF value of a herd.[1] However, this current research focused on management factors of dairy enterprises. Total herd size, facility type and monensin use, both as a feed supplement and a controlled release capsule, were determined to have no significant effect on the ROF index ($p>0.1$). Selective and no dry cow intramammary antibiotic had a significant negative effect on the ROF index (Table 1). Conversely, E.coli vaccination and three times versus twice daily milking were positively associated with the index. Preventive treatments given as therapy to periparturient animals was associated positively with the ROF index. Seventy-five percent of the herds using preventive treatments prior to calving used calcium. Total mixed ration (TMR) feed preparation as compared to component feeding was marginally significant (Table 1).

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Table 1. Relationship between management factors and ROF (n=148; r^2=0.30)

Management factors		Coefficient	p-value
Dry cow intramammary antibiotic[1]	Selective	-0.7531	0.032
	None	-1.2767	0.033
TMR feeding		0.5923	0.058
3X milking		1.1977	<0.001
E.coli vaccination		0.6712	0.003
Preventive periparturient therapy		0.5219	0.016

[1]Dry cow therapy to all cows as referent

[a]*Presented at the 2003 American Association of Bovine Practitioners Conference, September 18-20, 2003, Columbus, Ohio.*