

An Updated Procedure for Cecal Cannulation in Sheep and Cattle

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Abstract

Fifteen cattle (236–500 kg) and 38 sheep (36–55 kg) were fitted with 2 types of indwelling cecal cannulae. Cannulae were made of either clear silicone or plastic tubing. The surgery was conducted in a one-step procedure that involved pharmaceuticals and equipment that were readily available. Results indicated a success rate of 67% (33% failure due to inability to locate the cecum at the time of surgery) in cattle and 100% in sheep. Both cannula types tested were acceptable, but the cannula made from plastic tubing was more desirable because it was less bulky, more durable, and easier to construct. Animals fitted with cecal cannulae appeared to be healthy and to have normal life spans.

Key Words: cecal cannulation, cattle, sheep

Procedures for cecal cannulation were described more than 30 years ago by Dougherty (1955). Phaneuf (1957) later used these techniques in early experiments on digestive physiology of sheep. More recently several researchers have reviewed hindgut digestive physiology (Ulyatt et al. 1975, Hoover 1978, and Stevens et al. 1980). Unfortunately, the publication of cecal cannulation procedures has not kept pace with the increase in research on hindgut digestion. DeGregorio et al. (1982) reported using an indwelling T-type cannula in the cecum of sheep; however, their procedure was only briefly outlined. Ralston et al. (1983) outlined a procedure for cecal cannulation in ponies. While the procedure may be adequate for ponies, it is difficult to adapt to sheep and cattle. The majority of researchers using cecal cannulae

have failed to cite a cannulation procedure or only give a brief outline of their procedure. This paper provides a detailed description of cecal cannulation procedure that is suitable for both sheep and cattle.

Materials and Methods

Cannula Types

Two types of cannulae were used in sheep and cattle. The first type is a modification of the silicone cannula described by Ralston et al. (1983). Its construction consisted of clear silicone caulk¹ poured onto a T-type mold and shaped with a putty knife dipped in 95% ethanol. Once shaped, the cannula was allowed to dry and assembled as shown in Figure 1. Cannulae used for sheep and cattle were 17-mm I.D. and 31-mm I.D., respectively.

The second type of cannula was made from clear plastic tubing² of varying diameters which depended on the size and species of the animal involved. For sheep we used 19.0-mm I.D. and 29.0-mm I.D. in cattle. Inside flanges were made by splitting and tacking the tubing flat to a board. To ensure the inside flanges maintained their shape, tacked tubing was heated for 30 min in a 100° C forced-air oven. After cooling, a hole 2 mm smaller than desired cannula barrel was cut into the center of the inside flange. Cannula barrels, 15 cm long, were cut from tubing of the appropriate inside diameter. Both the flange and barrel were soaked in cyclohexanone for 10 to 20 min. The barrel was then inserted into the pre-cut hole in the flange and rotated to ensure good contact. The whole unit was then placed in enough cyclohexanone to cover the joint and allowed to set for 10 to 15 min. Finally, each cannula was air dried for 72 h before being fitted with an outside flange as shown in Figure 2.

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¹Clear silicone rubber sealent, Ace Hardware Corporation, Oaks Brook, Illinois 60521.

²Plastic tubing, Kirkhill, inc., Downey, CA 90241.

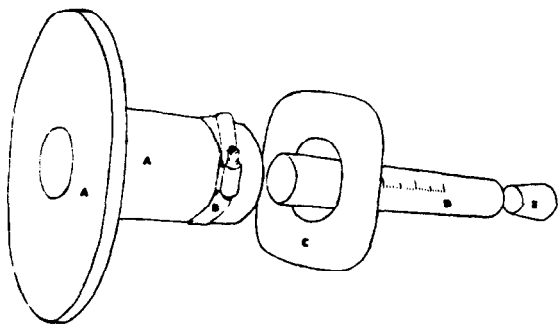


Fig. 1. Molded silicone cannula consisting of inside flange and barrel (A), hose clamp (B), outside flange (C), modified syringe barrel (D), rubber stopper (E).

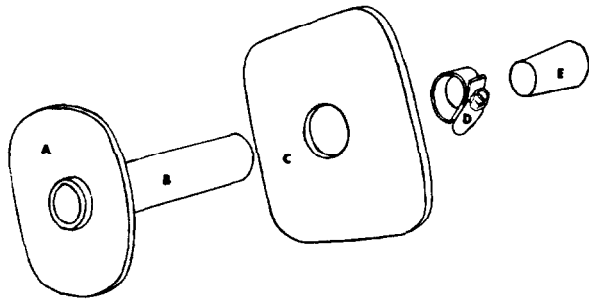


Fig. 2. Inside flange (A), cannula barrel (B), outside flange (C), hose clamp (D), rubber stopper (E).

Outside flanges were constructed from food container lids, but could be made from almost any type of plastic material.

Surgical Procedure

Over a 3-month period, 15 cattle (236–500 kg) and 38 sheep (36–55 kg) ranging from 6 to 36 months of age were selected for cecal cannulation. These animals were fasted for 24 h and withheld from water 12 h before surgery.

Sheep were placed on an operating table in left lateral recumbency, exposing the right side for surgery. All 4 legs and the head were restrained to prevent injury to either the sheep or the surgical team (Fig. 3). In cattle, surgery was performed using either

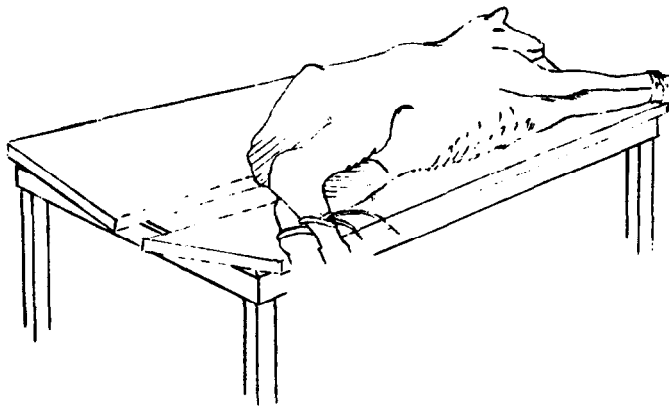


Fig. 3. Sheep positioned on surgical table.

a surgery table or a catch chute fitted with a standard headgate. Surgical anesthesia consisted of a regimen that minimized stress and pain. In most cecal cannulations, an intravenous injection of

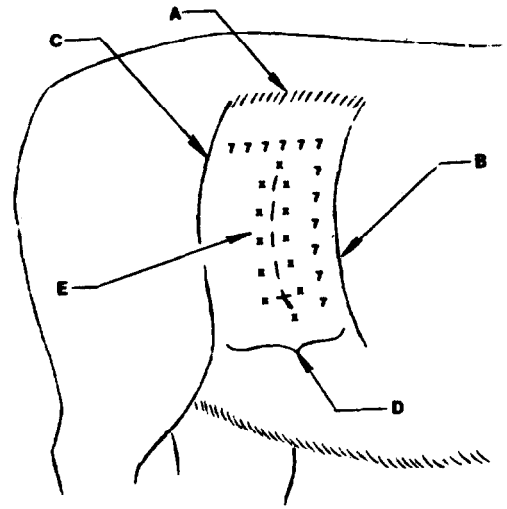


Fig. 4. Transverse processes (A), last rib (B), tuber coxae (C), surgical field (D), incision site (E), injection sites for line or "L" block (X and 7, respectively).

Sparine (promazine hydrochloride)³ was used as a general tranquilizer. Injections were given in the midrange dose of .66 to .77 mg/kg body wt if the animal was on a surgical table and the lower range dose of .44 to .55 mg/kg body wt if the animal was standing.

After adequate animal restraint, the surgical field (right paralumbar fossa and flank area) was located and, using Phisohex⁴ as a surgical scrub and Zephiran⁴ as a disinfectant, the area was prepared for surgery by standard preparation procedures. The incision site was located and anesthetized with 1% Xylocaine (Lidocaine hydrochloride plus 1:100,000 added epinephrine)⁵ using either a line or an inverted "L" block (Fig. 4). The inverted "L" block appeared to be more effective in desensitizing the area and is preferred to the line block. After administration of the local anesthetic, the surgical area was again flooded with Zephiran.

A 10.0 to 15.0-cm incision beginning approximately 5 cm ventral to the lumbar processes was made dorsoventrally through the skin underlying fascia and fat layers. Muscle layers were separated by blunt dissection whenever possible. After the peritoneum was exposed, between 0.5 and 1.5 cc of 1% Xylocaine was applied to the peritoneal surface to enhance anesthesia. The peritoneum was incised vertically with a scalpel and the incision lengthened with scissors. After the cecum was located and exteriorized, an incision just long enough to insert the cannula was made in the least vascular region farthest removed from the cecal artery. The incision was positioned 7.5 to 14.0 cm from the cecal apex, depending on the cecal size. After cannula insertion, the incision was closed with "0", "00" or "000" chromic gut using a Connell suture pattern described by Frank (1964). A purse-string suture of chromic gut was also placed around the cannula barrel to prevent leakage. When the cecum was exteriorized, the organ was periodically irrigated with sterile physiological saline to prevent adhesions. After returning the cecum to the abdominal cavity, the cannula was placed in the ventral apex of the incision site. The surrounding peritoneum and muscle layers were closed with "0" chromic gut, using a simple continuous suture pattern. After the peritoneum and muscle layers were sutured, 10 cc of Tri-sulfa⁶ was irrigated between the various muscle layers. The skin was sutured with nonabsorbable synthetic suture material (2/0 Braunamid)⁷ in an interrupted pattern. Tri-sulfa was also irrigated between the skin sutures and the incision surface was treated with a 3% solution

³Wyeth Laboratories, Inc., Philadelphia, Pennsylvania 19101.

⁴PhisoHex, Wyeth Laboratories, Inc., Philadelphia, Pennsylvania 19101.

⁶Anchor Laboratories, Inc., St. Joseph, Mo.

⁷B. Braun Melsungen AG, W. Germany. Importer: Jorgensen Laboratories, Inc. Loveland, Colo. 80537.

of iodine and a topical antibiotic (Furall)⁸. The outside flange was then affixed to the cannula. Antibiotic (Combiotic)⁹ was administered by intramuscular injection and the animal was housed in a recovery area.

Post-operative Care

Combiotic (procaine penicillin G and dehydrostreptomycin sulfate) injections were given to both sheep (8 to 10 cc) and cattle (15 to 20 cc) every 24 h for 3 days after surgery, and discontinued if the animal was progressing satisfactorily. If further treatment was needed, only procaine penicillin G⁹ was administered. Animals were maintained on a good quality alfalfa hay, including salt and minerals, and given fresh water daily throughout recovery. Incision sites were inspected once or twice daily and topical antibiotic and pesticide were applied as needed. Animals were usually ready for experimental studies 4 to 6 weeks following surgery.

Discussion and Conclusion

Currently, 15 cattle and 38 sheep have been cannulated with a success rate of 67% in cattle and 100% in sheep. The reduced success rate associated with cattle was attributed to the fact that many of the steers carried excess finish, which made locating the cecum extremely difficult. We were unable to locate the cecum at the time of surgery in 5 of the steers, thus, we had a lower percentage of successful cecal cannulations in cattle than in sheep. Cattle weighing between 130 and 230 kg can be cannulated with little difficulty. Some variation in ease of sampling was observed and attributed to cannula position. Sampling was improved (cecal contents flowed much easier) if the cannula was located away from the blind end of the cecum, and positioned slightly more ventral than dorsal in the abdominal wall.

Both cannula types were acceptable for use in research. Modifications can be made in either cannula type by cutting the barrel and flanges to the desired length and shapes. In general, the plastic tubing cannula was preferable because it was less bulky, more durable and easier to construct. With both cannula types it was desirable to use outside flanges. These flanges prevented the cannula from being drawn into the cecum, which could result in the cannula becoming lodged in the large intestine with little chance of passage or removal.

⁸Farnam Companies, Omaha, Nebraska 68112.

⁹Agriculture Division, Pfizer Inc., New York, New York 10017.

This surgical procedure is simple and provides animals of good health and acceptable quality for experimental purposes. Several successful experiments have been conducted using animals fitted with cecal cannulae by this procedure (Caton et al. 1985, 1986a, b; Krysl et al 1986). Life expectancy of animals cannulated in this fashion is assumed to be near normal.

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