A Durable Esophageal Cannula for Sheep and Goats

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Highlight: Problems often arise in the selection of a permanent esophageal cannula to be used in fistulated animals. A permanent cannula constructed from PVC pipe and Plexiglas is described which has strength, rigidity, and durability while keeping costs to a minimum.

The esophageal fistula fitted with various types of cannulae provides a popular technique for estimating dietary constituents of range animals. Cannulae are continually being modified to minimize cost, weight, and animal stress, while maximizing efficiency and durability. Types of cannulae have been adequately described by Van Dyne and Torrell (1964). Construction materials mentioned included latex, stainless steel, and lucite. Acrylic resin tubing and butyrate plastic also have been used, but these were easily broken (Veteto et al. 1972). Thus, stronger materials are desirable.

Lesperance et al. (1974) reported a permanent cannula is neither necessary nor desirable due to reduced recovery of ingesta. Further, a permanent cannula may cause the development of a "pouch" anterior to the fistula (Van Dyne and Torrell 1964). However, the permanent cannula is advantageous because it minimizes animal stress, reduces the chances of the fistula closing upon removing the cannula for extended time periods, and increases the ease and efficiency in obtaining diet samples. Two construction materials for permanent cannulae are described in this paper and their advantages are enumerated.

Materials and Methods

The cannulae were made of two easily obtainable materials, polyvinyl chloride (PVC) and Plexiglas (Fig. 1). The cannulae are modified from the Type D cannula described by Van Dyne and Torrell (1964). In our cannula design, the cap end of the Plexiglas neck was threaded with right-hand threads (17/inch) and the flange end with left-hand threads (17/inch). This type of construction prevents unscrewing the neck from the flange when removing the cap.

The chemical agents used to join the two materials were methylene chloride (PVC to PVC) and vinyl adhesive[1] (PVC to Plexiglas). Threading of the two materials required the services of a machine shop; however, the majority of the labor in producing a cannula of the type shown in Figure 1 involves an electric buffer and sand paper.

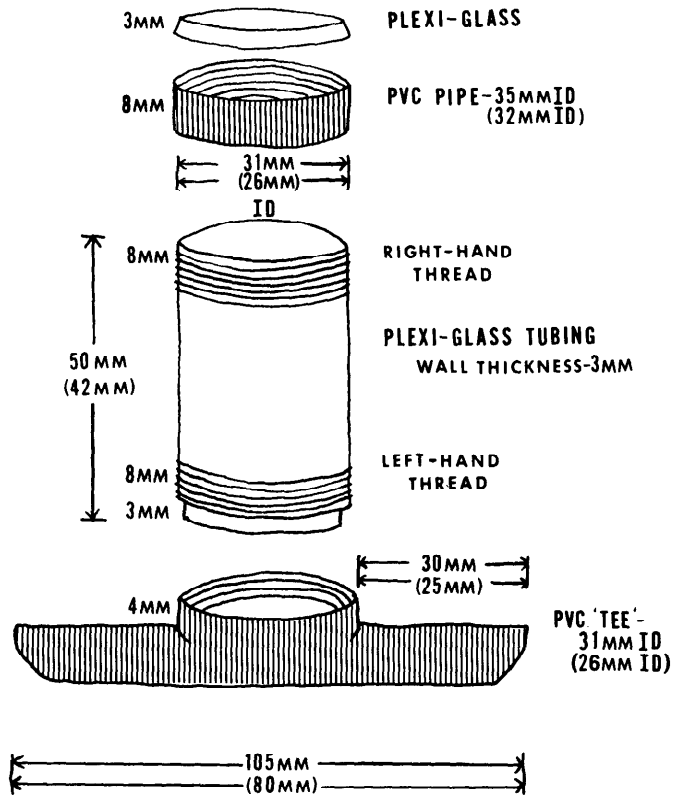

Fig. 1. *Diagram of complete cannula with dimensions for sheep and goats (in parenthesis).*

The cost per cannula in 1975, excluding labor of a technician, was approximately $17.

Cannula construction is relatively simple and dimensions are easily varied according to individual needs (Fig. 1). The dimensions shown have been found most useful in sheep and goats. Van Dyne and Torrell (1964) recommend a 30-mm inside diameter for sheep. For Spanish (meat-type) and Angora goats, a 26-mm inside diameter is more desirable because their esophagi are smaller than the sheep's. Veteto et al. (1972) found this size cannula also worked well in tractable white-tailed deer (*Odocoileus virginianus*). However, percent recovery of ingesta in all size cannulae has not been adequately investigated (Lesperance et al. 1974).

The length of the cannula neck should be 50 mm for sheep and 42 mm for Angora goats (Fig. 1). If used in Spanish goats or deer, this length should not exceed 25 mm.

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[1] CADCO—adhesive, SC-203; Cadillac Plastic and Chemical Co., 5031 Gulf Freeway, Houston, Texas 77023.

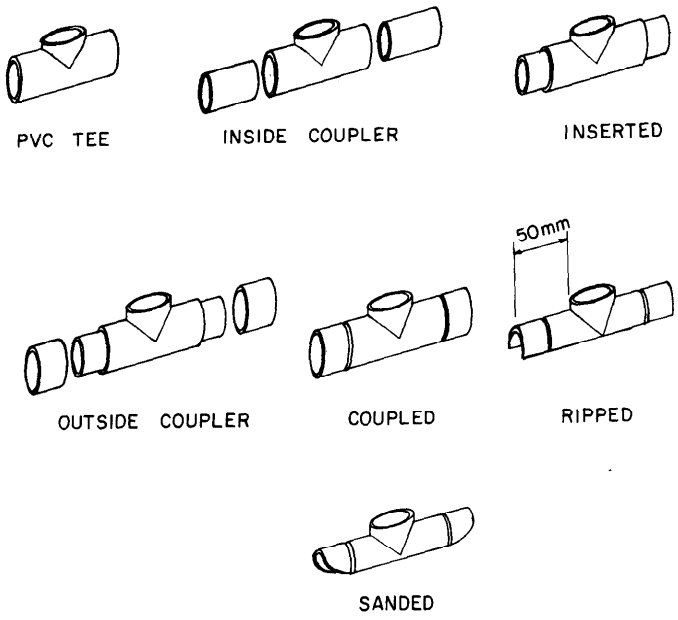

Fig. 2. *Diagram of flange construction from the basic PVC tee, including couplers for added length.*

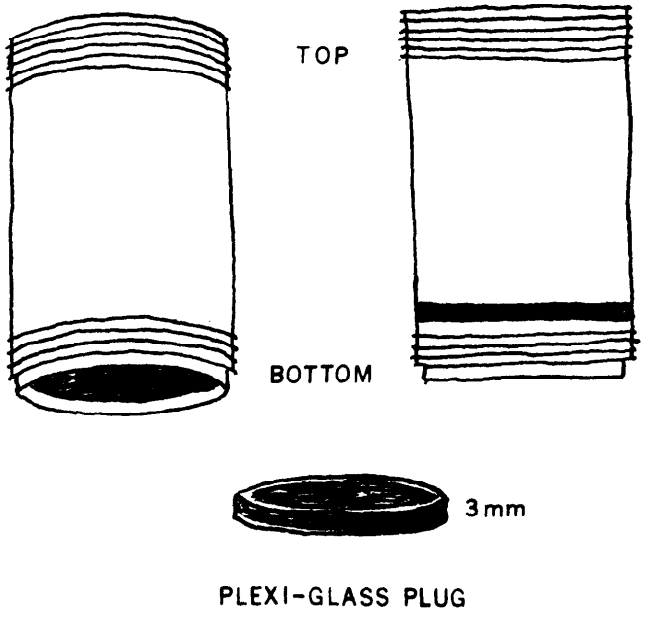

Fig. 3. *A cannula neck modified with a plug to prevent compaction of feed. This reduces the weight of the cannula in the animal's neck.*

The 3-mm extension at the base of Plexiglas tubing has two advantages (Fig. 1). Upon observation, it immediately distinguishes the left-hand from the right-hand threading. Also, the extension provides a "fit" to enhance finding the thread when it becomes necessary to replace the cannula after removal for normal maintenance of the fistula.

Flanges should be at least 28–30 mm long for sheep and 26 mm for goats. If the PVC tee is too short, couplers are easily installed to add desired length (Fig. 2). Van Dyne and Torrell (1964) suggested short and long ends, with periodic switching of these, to maintain a healthy fistula. Our original cannulae were constructed with flange ends equal in length. Some animals have carried these 3 years with no serious problems, probably because the material is lightweight. Consequently, flanges described herein do not have short and long ends, although they may be so constructed.

Before threading the PVC tee, the anterior extension should be reduced from 6 mm to 4 mm (Fig. 1). This will reduce complication during surgery while the cannula is being inserted.

Plexiglas was selected over PVC as the material for constructing the neck of the cannula because its greater degree of hardness and thicker walls (3 mm) enhanced threading. We have also constructed PVC cannulae (43-mm inside diameter; 161-mm overall flange length) for use in cattle with excellent results. Four steers having thermal-setting plastic cannulae experienced numerous problems, namely compaction of forage and losing the cannulae when rubbing on or walking through brush. Since stronger neck material is desirable, we substituted Plexiglas with ABS pipe[2] (81 mm in length). After a 2-week adjustment period, the steers have been maintenance free for 6 months, even while kept in a brushy, 21-hectare pasture.

Our cannula caps do not have a plunger to prevent compaction of feed in the neck of the cannula. Compaction increases cannula weight, encourages formation of a "pouch," and may result in an expelled cannula or pressure necrosis. The animals fitted with the cannulae described were maintained in dry-lot because they were used to sample at least three different pastures each month. They were released to graze the pasture to be sampled a few days prior to diet collections. By changing their ration from an alfalfa pellet[3] to cottonseed cake[4], leakage, "pouch" formation, and pressure necrosis were significantly reduced except for a few problem animals. This was attributed to physical properties of the cottonseed cake.

For problem animals, a plug was glued to the inner wall of the cannula neck (Fig. 3). This closed neck was replaced with an open neck during diet collections.

Conclusions

A disadvantage with this cannula is that it is sometimes expelled, primarily by the Spanish goat. Similar problems arise with the Boer goat of South Africa when fitted with the Nebraska type cannula[5] (A. J. Aucamp, personal communication).

However, a permanent cannula constructed from PVC and Plexiglas offers numerous advantages. These include (1) optimum strength and rigidity without increasing weight, (2) low construction costs, (3) ready availability of materials, and (4) variability in desired dimensions. Paramount among these is that the researcher can tailor the cannula to fit individual needs.

Literature Cited

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Van Dyne, G. M., and D. T. Torrell. 1964. Development and use of the esophageal fistula: a review. J. Range Manage. 17:7-19.

Veteto, George, C. E. Davis, Ray Hart, and R. M. Robinson. 1972. An esophageal cannula for white-tailed deer. J. Wildl. Manage. 36:906-912.

[2] Acrylonitrile—butadiene—styrene.

[3] Guaranteed analysis of alfalfa pellets: Crude protein—10%; crude fat—1.5%; crude fiber not more than 20%.

[4] Guaranteed analysis of cottonseed cake: Crude protein—41%; crude fat—4%; crude fiber not more than 14%.

[5] Precision Machine Company, 2933 North 36th Street, Lincoln, Nebraska.