Fistulated ruminants have played an important role in research concerning the rumen and ruminant nutrition. A cannula tightly sealed in a fistula would insure a cleaner, more easily cared for fistulated ruminant, and maintain a more normal rumen environment.

This report deals with a liquid and gas-tight fistula-cannula, which can be made easily from inexpensive materials. This cannula was developed primarily for the fistula of an isolated rumen pouch (Komarek et al., 1960), however, it has proven equally satisfactory for access to the entire rumen.

Materials and Methods

A one liter polyethylene bottle (figure 1) and a rubber compression plug designed for vacuum bottles were the materials used to make the cannula. The upper part of the bottle was cut off in such a way as to include the neck and part of the flange of the top of the bottle (figure 1-b). With the polyethylene cap in place, the upper part of the cap and neck of the bottle were cut off, leaving 2 or 3 threads and a threaded ring (figure 1-a). The bottom of the bottle was also cut off (figure 1-c) and a large polyethylene ring (washer) was made from it. The bottom of a polyethylene bottle does not have uniform thickness and is for the most part thicker than the rest of the bottle. Its thickness was reduced with a power sander so that it became uniform and flexible. In some cases the opening in the neck of the cannula was re bored so that the vacuum bottle stopper would fit. The finished parts of the cannula are shown in figures 2 and 3 (exploded and assembled).

Fistula techniques have been described by Markowitz (1954) and Dougherty (1955). No attempt will be made to describe in detail the operative procedure except for those manipulations which are important in the installation of this particular cannula.

An incision was made a few inches posterior to the last rib to gain access to the rumen. After the rumen had been exposed an incision was made in the rumen just large enough for passage of the flange of the cannula. The incision was positioned posterior to the terminal section of the left ruminal artery and just anterior to the dorsal branch of the right ruminal artery which extends to the left side of the rumen. The cannula was inserted into the rumen and four interrupted sutures which were previously sewed into the outer edge of the cannula flange were stitched through the rumen and tied. A Murphy purse string suture was sewed around the edge of the ruminal incision and was drawn tight and tied. This suture technique tends to curl the edges of the incision inward insuring that the rumen serosa will come in contact with the cut edges of the muscle layers and skin.

An incision was then made in the upper left flank, anterior to the tuber coxae, caudal to the lumbar costal arch and just ventral to the fourth lumbar vertebra. This incision in the skin was made just large enough for the neck of the cannula to be forced through. The fascia was incised, the muscle fibers of each layer were spread by blunt dissection and the peritoneum was then incised. To facilitate forcing the cannula through the incision, a cone-shaped piece of aluminum was machined so that it could be screwed on to the top of the cannula before forcing it through the side of the animal and a threaded handle was made so that it could be inserted through the incision and screwed into the top of the cone (figure 4). Thus the cone and cannula were held firmly and the tissues were stretched over the ridge on the neck of the cannula with relative ease by working these layers over the cone with a scalpel handle. The peritoneum, the muscle layers and the skin were forced over the ridge on the rumen which lies just below the threads on the neck of the cannula. Penicillin in oil (300,000 units) was then spread under the ridge of the cannula. The polyethylene ring was slipped over the neck of the cannula and the threaded ring made from the cap was used as a nut and tightened forcing the ring against the ridge giving me-
CANNULA FOR RUMEN FISTULA

Results and Discussion

This type of cannula has been used on 20 sheep with rumen pouch preparations and on two with ordinary fistulas. It has provided a clean, neat, gas and liquid tight cannula. It is readily sealed and opened by merely flipping the lever on the compression plug.

Figure 1. The cannula is made from a one-liter polyethylene bottle by cutting at a, b, and c.

Figure 2. The finished parts of the cannula in an exploded view.

Figure 3. The assembled cannula (top scale in tenths of an inch).

The tightness of the cannula has been verified by the audible release of rumen gases which occurred when the cannula was opened. In addition, experimental bloat has been produced in sheep fitted with this cannula. The neck of the cannula protrudes only ½ in. from the side of the animal and thus is rarely subjected to mechanical disturbance by the animal. The entire cannula with plug weighs only 38 gm. Figure 5 shows a Hampshire ewe with a cannulated rumen pouch preparation. This photograph was taken three months subsequent to the operation and the cannula remained gas and liquid tight over this period.

Figure 4. Figure 5. The cannula in place.
The rigidity of the cannula and the relative flexibility of the scar tissue make it impossible for this cannula to be permanently gas and liquid tight. In most cases, after 3 to 4 months, a very small amount of rumen fluid was forced between the cannula and the scar ring which was formed around the neck of the cannula, but the preparation was still able to hold gas pressure. Even after 6 months, the amount of fluid forced out is not sufficient to require much attention to keep the animal clean and neat in appearance.

The size of the flange on the cannula is a compromise between the mechanical strength which a larger flange would give and a minimal incision of the rumen. Fortunately, the flange on the polyethylene bottle is much larger than is needed and if a modification in the size of the flange is desired, there still is the possibility that a one liter polyethylene bottle would be sufficient. There are also larger polyethylene bottles with this type of construction, which could easily be adapted to larger ruminants.

Figure 5. Ewe with cannulated rumen pouch. This photograph was taken 3 months after the introduction of the cannula.

The vacuum bottle compression stopper can be modified, so that pressure readings, infusing or sampling can be done through the stopper by replacing the central shaft of the stopper with a tube so constructed that compression of the rubber segment is still possible.

Although this cannula preparation has been used with sheep, the basic technique is applicable to all ruminants if the skin and muscle layers will fit under the ridge on the neck of the cannula and if the size of the cannula is ample for the work planned.

Summary

A cannula has been perfected which can be made from inexpensive materials and which will give a satisfactory gas and liquid tight seal. The cannula described will permit the entrance of a tube of up to 22 mm. in diameter. This cannula has been used in sheep, but the same technique could conceivably be used for larger ruminants.

Literature Cited