

A New Esophageal Plug

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Abstract

An esophageal fistula plug was constructed from polyvinyl chloride pipe at a material cost of approximately \$3.50. The plug has a plastisol and metal washer and is held together with a hose clamp. The hose clamp is adjusted to exert light pressure on the neck by the washers to reduce scar tissue around the fistula. The size of the plug can be varied by changing the diameter of the pipe allowing it to be used as a fistula dialator.

Successful diet sampling with esophageally fistulated animals requires maintenance of an adequate fistula opening. Closure of the fistula because of swelling or accumulation of scar tissue will restrict passage of extrusa from the fistula. Loss of fistula plugs or extended sampling from animals with removable plugs usually results in swelling and closure of the fistula opening (Anderson and Mertz 1982). This makes replacement of the plug difficult and stressful to the animal. The accumulation of scar tissue around the fistula is normal and may limit the usefulness of a fistulated animal.

This paper describes an inexpensive removable fistula plug that reduces formation of scar tissue and assists in expanding fistula openings that have closed because of trauma or were not of the desired size following initial surgery.

Materials and Methods

The cannula is a split "T" type that is fabricated from polyvinyl chloride (pvc) pipe and fittings. The materials required to construct a cannula with an outside diameter of 50 mm are: 1-32 mm (1 1/4 in.) tee; 2-32 mm (1 1/4 in.) couplings; 1-25 mm (1 in.) coupling; 1-25 mm (1 in.) threaded plug; 226 mm of 32 mm (1 1/4 in.) pipe; 95 mm of 25 mm (1 in.) pipe; pvc cleaner; pvc glue; and 1-50 mm

stainless steel hose clamp. The pipe and fittings are all schedule 40 pvc. Sizes are standard nominal measurements and total cost of the materials is about \$3.50.

Construction is begun by gluing a 63 mm piece of 32 mm pipe into each arm of the tee and a 100 mm piece into the base (Fig. 1A). Next a 32 mm coupling is cut in half on a plane parallel to the ends. One of the halves is glued over the pipe extending from each of the arms of the tee. Then the stop around the inside wall of a 32 mm coupling is ground off and the coupling is glued over the pipe extending from the base of the tee (Fig. 1B). The esophageal plug is formed by cutting the arms of the tee in half on a plane perpendicular to the base and then cutting the base in half on a plane perpendicular to the long axis of the arms (Fig. 1C). The ends and edges of the arms are rounded with a file and sanded smooth to form the flanges of the plug. A 5 mm wide ring is cut off the 25 mm coupling and glued to one end of the 95 mm piece of 25 mm pipe. Then the threads are ground off the 25 mm plug and the plug is glued into the other end of this paper and ground smooth. This forms a stopper for the esophageal plug (Fig. 1D).

Two washers, one made of plastisol and the other of metal, and a hose clamp are used to hold the esophageal plug in place after it is in the animal. The mold for the plastisol washer consisted of the lid to a soil tin (95 mm diameter) with a #10.5 rubber stopper in the middle to form the hole. The weight of the completed esophageal plug with washers is 325 g. The assembled plug is shown in Fig. 2A.

The plastisol washer is placed proximal to the neck followed by a metal machine bushing. A hose clamp with several wraps of plastic tape around the side opposite the screw is used to hold the esophageal plug together and the washers in place. When the plug is in place, the washers are adjusted so that the plastisol washer exerts light pressure on tissue around the fistula (Fig. 2B).

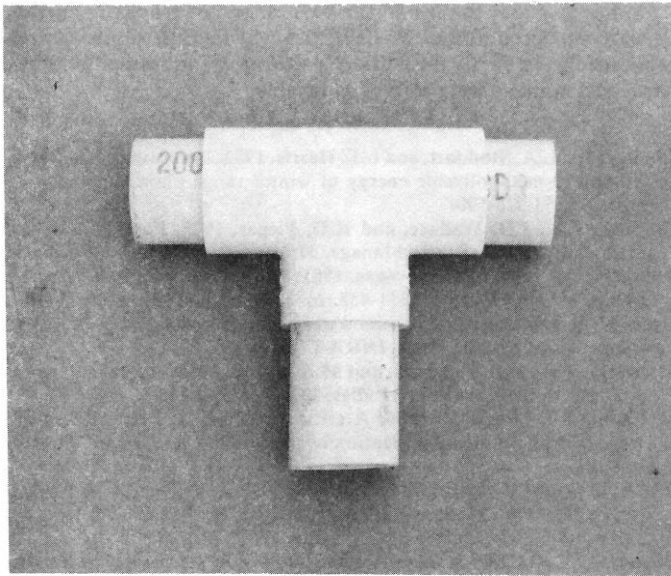
Discussion

The esophageal plug described in this paper is similar to the ones described by Breen and Hunter (1976), Taylor and Bryant (1977)

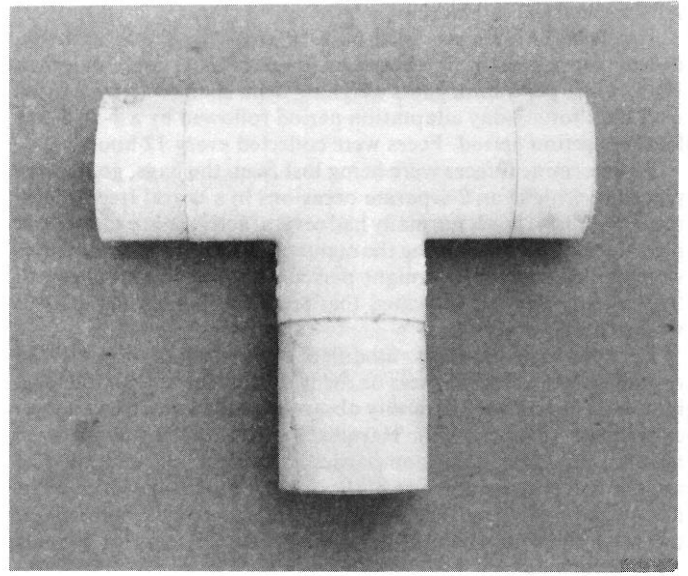
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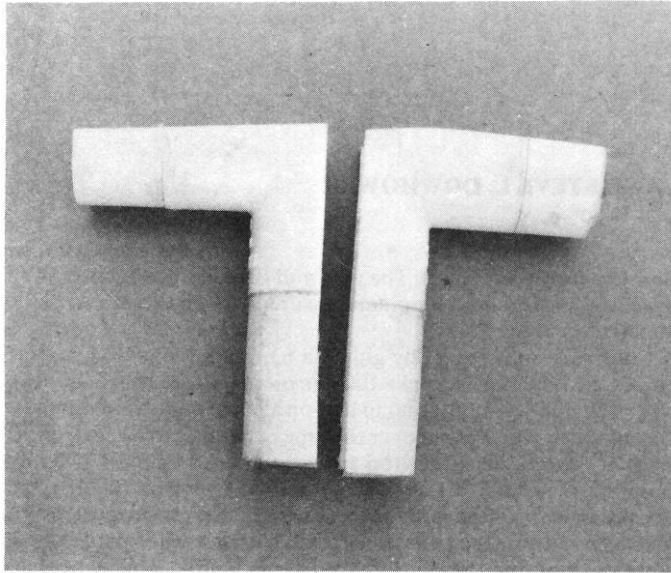
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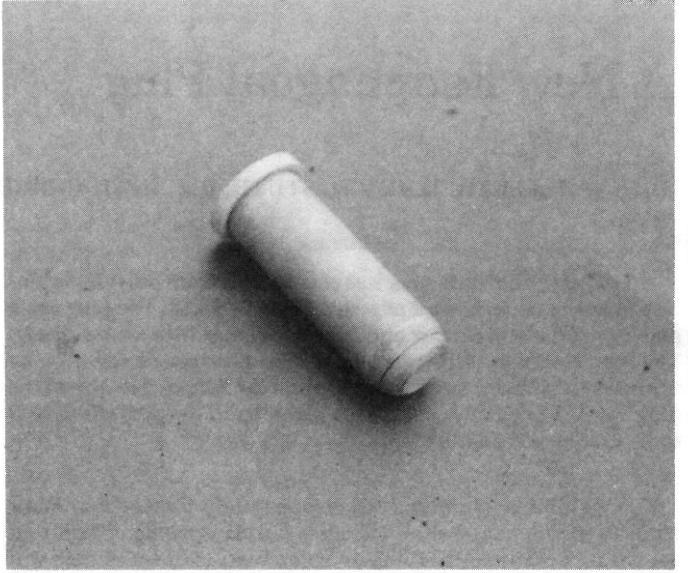
A



B

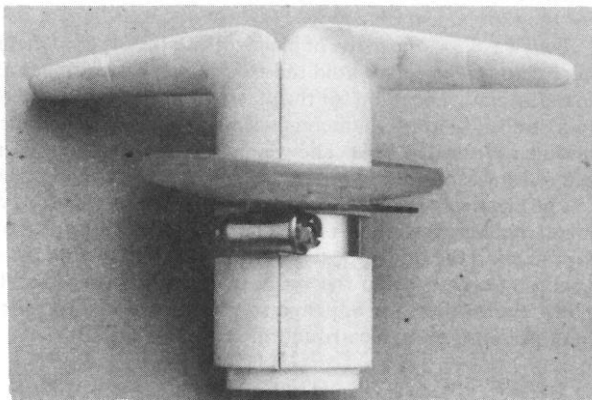


C

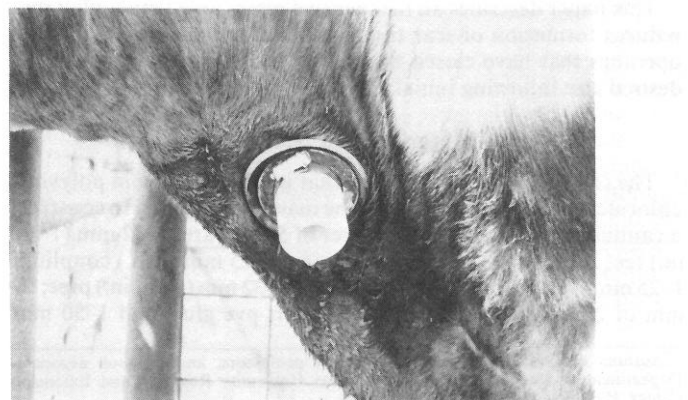


D

Fig. 1. Construction of an esophageal plug (A) tee with pipe inserted, (B) tee with couplings (C) tee cut through the arms and base, (D) stopper for esophageal plug.



A



B

Fig. 2. (A) Completed esophageal plug with washers. (B) An esophageal plug inserted in a steer.

and Denney (1981). The flange of the plug described in this paper was constructed similar to the one described by Taylor and Bryant (1977) except that theirs was a permanent cannula and was not cut in a plane perpendicular to the arms of the flange. The plugs described by Breen and Hunter (1976) and Denny (1981) were similar to this plug in form and function but were constructed from a solid piece of polyethylene. This plug has the same advantages of being rarely dislodged, of light weight, nonirritating, and permitting low maintenance of esophageally fistulated animals. The use of pvc pipe facilitates construction, and the size of the plug is easily changed by using different dimension pvc pipe. Furthermore, the hollow base facilitates plug replacement in an esophageal fistula which has contracted during sampling. The washer has reduced problems caused by forage blockage of the esophagus. Six steers outfitted with these plugs have been maintained for 6 months on dormant mixed grass forage with no problems. Prior to using the washers, we experienced occasional problems because of esophageal blockage.

This esophageal plug can also be used as a fistula dilator because the washers reduce scar tissue around the fistula. We have used this plug to dilate fistulas on two steers that had 40 mm outside diameter esophageal plugs to accommodate 50 mm outside

diameter plugs. The steers were initially fitted with the 40 mm plug without washers, when fistulated at 8 months of age. Our initial attempt to insert a 50 mm plug 7 months after the surgery was unsuccessful because of the presence of excessive scar tissue around the fistula. The scar tissue was subsequently reduced by reinserting the 40 mm plug and using the washers. The washers were adjusted so that moderate pressure was exerted on the tissue around the fistula. After 2 weeks, the thickness of the tissue around the lumen of the fistula was reduced from 23 mm at the ventral border and 15 mm at the dorsal border to 11 and 10 mm, respectively. The 50 mm cannula was then inserted with no apparent stress to the steers.

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