EXPERIENCE WITH VINYL-PLASTIC ENDOTRACHEAL TUBES *

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FOR several types of surgical patients the maintenance of a free airway during operation by employment of an efficient endotracheal tube is of prime importance. In no place has this technic greater importance than in dealing with those patients undergoing maxillofacial and neurosurgical operations. The increased bleeding produced in such operative fields by any respiratory obstruction, the possibility of herniation of the brain during craniotomy, and the serious effects of anoxia in patients with intracranial lesions all make this a matter of paramount importance.

Since Magill's introduction of that type of endotracheal tube which bears his name, rubber has remained the material of choice for its manufacture. It will be universally agreed, however, that the rubber Magill tube falls short of the ideal in many ways. It may become obstructed by kinking in the nasopharynx when used in nasotracheal intubation; movement of the head which flexes the tube acutely or applies a torsion to it will obstruct it, and sterilization results in rapid deterioration no matter what method is employed.

Attempts have been made to produce synthetic rubber tubes and plastic tubes, but those samples which have previously come to our attention have failed to reproduce the flexibility of rubber, and as a rule have required too thick a wall for the lumen available to make them practical.

Recently the authors were introduced by Major H. L. Thornton, R.A.M.C. (1), to a vinyl plastic tubing for endotracheal airways. This tubing appeared to have definite advantages over rubber tubing for this purpose. We have used it for some months, and these advantages have been so well confirmed that in our practice endotracheal tubes made of this material have entirely displaced those made of rubber.

The vinyl-plastic tubing used has been designed with a view to overcoming the disadvantages of rubber endotracheal tubes to the greatest possible extent, while retaining the pliability, resiliency and atraumatic qualities of rubber tubing. A number of samples were produced before one was obtained which appeared to have the properties required. The samples which we have used have been of two dimensions. In the

* Manufactured by Portland Plastics, Ltd., who hope to make "Vinyl Portex" plastic endotracheal tubes available in the U. S. A. some time in the future.

first sample the lumen has a diameter of 6.5 mm. and the outside a diameter of 10 mm. This tube had too large an outside diameter for the lumen available, and was replaced by tubing in which the diameter of the lumen was 7 mm. and of the outside, 9 mm. This tubing has been satisfactory in average adult male patients for both orotracheal and nasotracheal intubation.

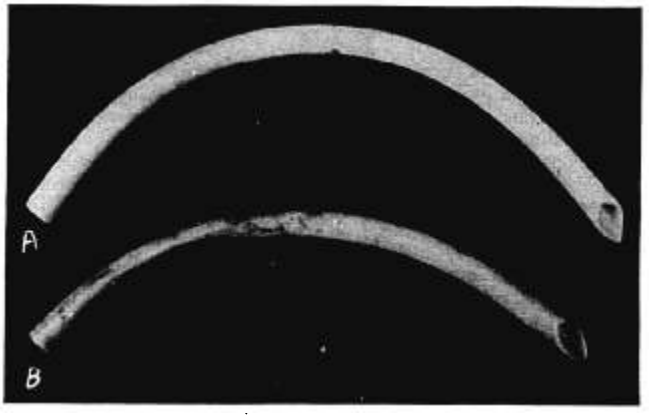

FIGURE 1

A. New vinyl endotracheal tube.
B. Similar tube after repeated boiling after four months' use, showing color changes.

The tubing is extruded in a curve during manufacture, and has been supplied in coils of 10 inch diameter. It is stored in a coil of this diameter in the same way as rubber tubing for Magill tubes. The endotracheal tubes are prepared for use by cutting the bevel on the end of the desired length of tubing with a scissors or a knife. The bevelled end is then smoothed down with a hot spatula, and may be polished by the use of a small cloth moistened with chloroform.

This tubing when new is white and semitranslucent, although it becomes more opaque and slightly yellowish in color with repeated boiling. It is probable that in the near future a transparent tubing having the same characteristics will be available.

The disadvantages of rubber endotracheal tubes have been largely overcome in this tubing. Whereas the majority of rubber endotracheal tubes will obstruct by kinking when acutely flexed, this tubing remains patent. This is more marked at body temperature than at room temperature, since the vinyl tubing becomes softer and more malleable as the temperature rises.

Obstruction by kinking will also be produced in rubber tubing by application of torsion, such as occurs when the head is rotated while both ends of the endotracheal tube remain fixed. Such torsion does not produce obstruction of the lumen in the vinyl tubing.

Rubber tubing deteriorates very rapidly when sterilized by boiling, becoming soft and losing the original curve. Vinyl plastic tubing may be boiled repeatedly with very little evidence of deterioration. Such deterioration as results from boiling is seen in a gradual increase in firmness of the tube. The curve of the plastic tube is preserved after boiling by holding it in the proper curve during cooling. We have achieved this end by slipping the tubes over wire forms before boiling, leaving them in place until the tube has cooled after removal from the sterilizer.

The vinyl-plastic tubing under consideration withstands a circumferential pressure of up to 350 mm. of mercury at room temperature without significant reduction of the lumen. It is less likely, therefore, to be obstructed by the pressure of pneumatic cuffs of pharyngeal packs than is rubber tubing.

The durability of this tubing is well demonstrated by the fact that we have performed intubation of 710 patients during the past three months with only seven of these endotracheal tubes, which are still in use. These tubes have been boiled between cases for periods ranging from ten to twenty minutes.

The tubing used has been provided through the courtesy of Portland Plastics, Ltd., of London, England, and is designated as "Vinyl Portex Tubing."

SUMMARY

Experience with vinyl plastic endotracheal tubes is reported. These tubes have proved to be superior to rubber tubes in the matter of durability, ease of sterilization, and clinical use in a considerable series of cases.

REFERENCES

1. Thornton, H. L.: Vinyl-"Portex" Tubing, Brit. M. J. 2:714 (July 1) 1944.
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