The Oxford non-kinking endotracheal tube

Results of its use in about 18,000 cases

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The hazard of endotracheal tubes which become kinked and cause obstruction of the airway has been appreciated for many years and a number of methods of avoiding this have been suggested.

In 1955, Alsop of Oxford, described a right-angled tube which was designed for the purpose of eliminating this particular danger. This tube has been used in the United Oxford Hospitals during the past six years for approximately 18,000 anaesthetics. By now, sufficient evidence should have been accumulated to assess its advantages and disadvantages and whether it has, in fact, proved to be unkinkable.

FIG. 1A The Oxford endotracheal tube
The tube (FIG. 1A) is made in sizes 3–10*, which indicate the diameter in mm, \( \frac{1}{2} \)mm increments are available in the smaller sizes. The rubber, which is thick and firm in its upper part, tapers so that the external diameter of the tube lying in the sub-glottic region is considerably smaller than that in the mouth (FIG. 1B).

**INSERTION**

Although unnecessary in small children and edentulous adults, the use of a stilette (conveniently provided by using a gum elastic olivary tipped bougie), projecting approximately \( 1\frac{1}{2} \) in beyond the lower end of the tube, can sometimes make insertion easier.

**INVESTIGATION OF NON-KINKING PROPERTIES**

In investigating the claim that the tube was non-kinking, inquiry was made of anaesthetists using it in clinical practice. No reports of obstruction due to kinking were obtained. In addition, a radiologist reported that there had been no evidence of kinking on radiographs of patients undergoing cerebral angiography and encephalography, when the Oxford tube was used. X-rays were taken of an intubated patient with the head extended, with the head flexed (FIG. 2), and in the prone position. None of these positions provoked kinking.

Thus, although not conclusive, this evidence suggests that the claim to be non-kinking is justified.

*A tube of 3mm internal diameter with finer tapering in the terminal part, suitable for premature infants is at present under trial (J. V. Mitchell – personal communication).
FIG. 2 The Oxford tube with the head in acute flexion

**COMPARISON WITH STANDARD ENDOTRACHEAL TUBE**

With the object of comparing the results of the radiological findings in the Oxford tube with those in a standard Magill tube, a retrospective study was made of the X-rays of patients subjected to similar investigations under general anaesthesia in whom an oral Magill tube had
been used. In four adults and two children, kinking of the tube was visible on X-ray. In the former group it occurred at the junction of the mouth with the pharynx and in the latter two just beyond the junction with the Rowbotham endotracheal connection.

**RESISTANCE OF KINKED TUBE**

No history of difficulty in ventilation could be obtained in any of the cases where kinking of the tube was seen on X-ray; so an experiment

![An example of a Magill tube kinked in the oropharynx during cerebral angiography](image)
was undertaken to determine the increase in resistance of kinked Magill tubes.

METHOD

Nos 8, 9 and 10 Magill tubes of identical lengths (FIG. 4) were fixed at an angle similar to that of the Magill tube in FIG. 3. With a 30L/minute flow of air passing from a large vessel into the tubes, the resistance of each was measured using a water manometer. The experiment was repeated with the tubes uninked.
These results demonstrate that minor degrees of obstruction, such as those found on the X-rays of these patients will, without being clinically apparent, increase the resistance to air flow. Further, that the smaller the tube, the greater will be the increased resistance.

The second part of the experiment demonstrated no difference in the resistance of Oxford and Magill tubes of similar internal diameter and length.

**GENERAL USE**

The Oxford tube has now been used for a wide variety of general surgical procedures. In many instances no particular advantage over the Magill tube can be claimed. However, particular advantages are encountered in cases where displacement and kinking of a standard tube are recognised hazards. In neurosurgical procedures, not only is the risk of kinking with the head in the fully flexed position excluded, but the shape of the tube tends to prevent it from slipping out in the prone and sitting positions. The thick, firm, proximal end of the tube prevents any tendency to kink at the junction with the endotracheal connection. This is a matter of some importance in plastic surgery of the head and neck, where pressure may accidentally be exerted on the endotracheal connection as it leaves the mouth and lies beneath the sterile towels. The tube has met with the approval of both surgeons and anaesthetists in operations for the repair of cleft palate, where it lies conveniently under the blade of a Dott gag without being occluded by pressure.

The tapering distal part permits the use of a tube of relatively larger internal diameter in infants and small children, where the sub-glottic region has a smaller diameter than that of the larynx.

**DISADVANTAGES**

Although trouble free in most instances, the tube has two unsatisfactory features. In spite of the fact that the length of the tube has been carefully designed, the tip was found to have entered the right main bronchus in an infant on one occasion.

Occasionally, with extreme flexion of the head, the bevel at the distal end of the tube has been pressed against the posterior wall of the...
trachea. Any danger of occlusion of the airway when such an abnormal position is anticipated, may be prevented by cutting a hole in the anterior wall which should be equal in size to the cross section of the tube. Neither of these disadvantages is peculiar to the Oxford tube, the former being more likely to occur with other tubes and the latter having been described in connection with flexometallic tubes some years ago.

**DISCUSSION**

On the occasions when the Oxford tube has been found particularly valuable the alternative would have been to use a latex covered nylon or wire spiral tube. These tubes are less hard wearing and kinking may occur at the endotracheal connection where the armouring ends. Furthermore, it has been found that red rubber swells less than latex in the presence of volatile anaesthetics, a factor which may be of considerable significance in the smaller sized tubes.

A further disadvantage of the armoured latex tube is a tendency for the inner layer to separate and thus obstruct the lumen. In spite of widening the metal coil to improve the adhesion between the spiral and latex, herniation of the inner layers of latex may still occur.

**CONCLUSION**

The Oxford tube has been used in over 18,000 anaesthetics and has proved satisfactory. It is as efficient as the latex covered tubes in preventing kinking and is free from the disadvantage of herniation of the inner layers of rubber. The facts that it is easily inserted, is hard-wearing and not expensive, and does not swell appreciably in the presence of volatile anaesthetics, make it suitable for routine use instead of the standard Magill tube. Its routine use would reduce the risk of unnoticed partial obstruction by kinking, an occurrence which has been demonstrated as an incidental finding on radiographs taken for cerebral angiography and encephalography.

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References