A NEW DOUBLE-CURVED ENDOTRACHEAL TUBE FOR NASAL INTUBATION

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SUMMARY

The upper airway makes a curve with its convexity following the natural lordosis of the cervical vertebrae, which interferes with the introduction and satisfactory positioning of a nasal endotracheal tube, particularly one of the Magill pattern. To overcome this difficulty a double-curved, S-shaped, tube for nasal intubation has been developed and studied.

When the glottis is exposed with a Macintosh laryngoscope, the tip of a Magill tube inserted through the nose tends to point anteriorly as it glides over the posterior pharyngeal wall, and impinges upon the anterior commissure of the larynx.

Intubating forceps are often required at this stage. Gillespie (1948) suggests withdrawing the tube slightly, flexing the head acutely and then pushing the tube forward, while Galley (personal communication) believes it worth while to rotate the tube through 180 degrees, so as to turn its concavity posteriorly before pushing it forward. In our hands Galley’s manoeuvre has been more successful than Gillespie’s. Once it has entered the trachea the tube exerts continuous pressure on the anterior surface of the upper airway, as the trachea passes posteriorly from the level of the sixth cervical vertebra, and may lead to traumatic changes in the mucous membrane as shown by a posterior laryngeal ulcer and anterior tracheal mucosal trauma (Dwyer, Kronenberg and Saklad, 1949). These results are likely to be greater in patients in whom the deflections of the upper airway are pronounced.

The pressure exerted by a rubber Magill tube inserted nasally has other clinical significance apart from its possible traumatic effects. A deeper plane of anaesthesia may be needed than is actually required by the operative procedure. Flexion of the head and neck will reduce the pressure but is not always practical. Even minimal extension of the head may lead to violent reflex activity since it increases the pressure exerted by the tip of the tube on the trachea. It is possible that some upper respiratory tract complications following operations on the anterior part of the neck may be explained by these facts. Dwyer, Kronenberg and Saklad (1949) originally considered these traumatic effects and Hugenard and Jaquenoud (1960) advise a 180-degrees rotation of orally introduced endotracheal tubes to prevent any such complications. This is an effective procedure especially when the progress of the tube is hindered by the anterior tracheal wall, but it is not practical for maintenance of anaesthesia with a nasally introduced tube. The Oxford endotracheal tube exerts less pressure on the tracheal and glottic structures than the Magill, but is not suitable for nasal intubation. Flexometallic and latex-covered tubes are designed to suit every curve of the upper airway but they, too, cannot be passed through the nose. Plastic endotracheal tubes are said to mould to the curvatures of the airway at body temperature and sometimes after removing the tube it is noticed that they maintain the S-shape of the upper airway. Despite the fact that these may cause trauma during insertion, they are the best tubes currently available.

The anatomical problems, difficulties with currently available tubes, and a consideration of Galley’s manoeuvre and Hugenard’s technique for maintenance of an orotracheal tube, led to experiments with an S-shaped, double-curved, tube with one curve for the nasal cavity and pharyngeal airway and one for the laryngotracheal junction (fig.
A simple procedure has been used for changing the curve of a Magill tube to an S, by passing a copper stilette through it, bending both to the desired shape and then autoclaving them for 2 hours to make it maintain its S-shape after the removal of the stilette. In 1965 we came across the Rusch anatomically shaped tube described by Kuhn (1963), which has a similar design to follow the orotracheal airway and has a lateral bevel at the tip. Rusch tubes are not, however, suitable for nasotracheal intubation as the curvature of the nasotracheal tube is somewhat different from the orotracheal tube.

**THE TEHRAN UNIVERSITY S-TUBE**

This 30-cm endotracheal tube has two equal curves (fig. 1) so that as it lies in situ it is parallel to the posterior wall of the nasopharynx (fig. 2). The bevel is cut in reverse to the terminal concavity of the tube and an extra hole on the opposite side to the terminal opening guards against occlusion by the wall of the trachea. This tube has been made from two materials: rubber for ordinary short-term usage, and soft plastic for resuscitative purposes. This tube is not yet available commercially.

**Introduction of nasotracheal Tehran University tube.**

The tube, held with its terminal curve anteriorly, is passed through the nares directly backward following the line of the palate. At this stage, the bevel faces posteriorly and the point of the tube turns downward avoiding trauma (fig. 3). Laryngoscopy is now performed and the tube passed further so that its tip glides over the anterior part of the larynx, at which stage it should be rotated through 180 degrees and pushed into the trachea (fig. 4). Almost always nasotracheal intubation can be easily achieved by slight rotation of the tube at the moment its tip enters the glottis or by change of position of the tip of the laryngoscope, and the tube itself tends to slide gently and smoothly over the posterior part of the glottis. In 100 cases of visual nasal intubation we have encountered no problems, though some previous
DOUBLE-CURVED ENDOTRACHEAL TUBE FOR NASAL INTUBATION

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FIG. 3
Showing the method of introduction of the Tehran University S-tube.

FIG. 4

attempts with a Magill tube had been difficult. In two patients, both over 50 years old, introduction of the tube either orally or nasally into the trachea was impossible without rotation, after it had passed the glottis.

Using a similar technique, blind nasal intubation has been found possible with an S-shaped tube in a small number of patients.

The S-shaped tube adjusts itself to the correct position in relation to the trachea so that nasal intubation is facilitated as it passes easily through the nasopharynx and is never hindered by the anterior tracheal wall. There is less chance of trauma whatever the position of the head during the operation and the risk of kinking the tube is eliminated. Anaesthesia can be maintained at a light level without fear of irritation from the point of the tube, even though the head is extended. Friction between a moving trachea and the tip of the tube is far less than with the Magill mineralized rubber tube so that there is less chance of the occurrence of complications, such as laryngitis, ulcer, granuloma and subglottic stenosis. In a series of 100 cases intubated by residents not a single symptom of laryngotracheal disturbance was observed. This may well be an important consideration when a nasotracheal tube is used for long-term resuscitative purposes, and in view of this it seems worthwhile to investigate this subject in a large number of cases. Indeed, limited experience suggests that an S rubber tube is better tolerated postoperatively than a conventional tube, though it might be wise to make the S-tube of soft plastic material for this special purpose.

CLINICAL INDICATIONS

The deflections of the laryngotracheal airway are often very pronounced in old age and in the male, as is predictable by inspection of the Adam's apple and palpation of the pathway of trachea in the neck. A double-curved or S-tube is particularly indicated for operations requiring excessive extension of the head (i.e., radical neck dissection, prone position), or immobilization of the head in the midline position (i.e., tonsillectomy, thyroidectomy), for lengthy operations and for resuscitative purposes when prolonged nasotracheal intubation is desired. It is also useful when a Magill tube cannot be easily passed, particularly during visual attempts at nasal intubation. On these occasions, however, if oral intubation is desired, the Kuhn-Rusch cuffed tube would be a good choice, but in our department the Tehran S-shaped tubes are now in routine use.

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REFERENCES


NOUVEAU TUBE ENDOTRACHEAL A DOUBLE COURBURE POUR L'INTUBATION NASALE

SOMMAIRE

La voie aérienne supérieure suit une courbure dont la convexité suit la lordose naturelle de la colonne cervicale. Cette donnée anatomique joue un rôle dans l'introduction et la fixation convenable d'un tube endotrachéal par la voie nasale, particulièrement quand il s'agit de tubes du genre Magill. Pour éliminer cette difficulté, un tube à double courbure en "S" pour l'intubation nasale a été mis au point et examiné.

LIVERPOOL SOCIETY OF ANAESTHETISTS

Programme for Session 1967–68

1967

FRIDAY, OCTOBER 27. 8 p.m.
Ordinary General Meeting at the Liverpool Medical Institution.
Speakers:
   DR. GLYN THOMAS.
   PROFESSOR CECIL GRAY.
   "The Anaesthetic Service in Liverpool."

FRIDAY, NOVEMBER 24. 8 p.m.
Ordinary General Meeting at the Liverpool Medical Institution.
Speaker: DR. BRIAN SELLICK.
Title to be announced.

THURSDAY, DECEMBER 7. 8 p.m.
Joint Meeting with the Liverpool Medical Institution at the Institution.
Speakers:
   DR. PHILIP PINKERTON.
   MR. NEIL FREEMAN.
   DR. GORDON BUSH.
   "The Burnt Child."

1968

FRIDAY, FEBRUARY 16. 8 p.m.
Meeting open to Members of the Liverpool Institution, at the Institution.
Speaker: PROFESSOR J. P. PAYNE.
Title to be announced.

FRIDAY, MARCH 15. 8 p.m.
Ordinary General Meeting at the Liverpool Medical Institution.
Papers presented in Competition for the Registrar's Prize.

THURSDAY, APRIL 25. 8 p.m.
Combined Meeting with the Anaesthetic Service of the Manchester Medical Society, at Manchester.
Speakers:
   DR. I. M. BROWN.
   Title to be announced.
   DR. J. B. HARGREAVES.
   "The Accident Centre at Walton Hospital."

FRIDAY, MAY 3. 8 p.m.
Thirty-sixth Annual General Meeting at the Liverpool Medical Institution, followed by social evening.