A Nylon Embedded Latex Connector for Nasotracheal Intubation

J. A. Bain, M.D., F.R.C.P.(C),* and W. E. Spoerel, M.D., F.R.C.P.(C)†

Nasotracheal intubation is used to maintain an airway in oral, maxillo-facial, and plastic surgery on the lower part of the face. The connection of the nasotracheal tube with the breathing system and its fixation and incorporation into the surgical drapes can give rise to difficulties. Commercially available angled metal connectors do not always fit the patient and, thus, often place the connection with the breathing system inside or near the surgical field.

The use of a single tube breathing system, i.e., the Magill attachment in adults and a modified Ayre's T-piece in children facilitated the anesthetic management of surgical procedures about the face.1 In place of the usual connector, a piece of armored endotracheal tube was used to bring the expiratory valve of the Magill system or the T-piece up above the patient's forehead; a malleable wire inside this connecting tube permitted molding to conform to the facial contours. A similar solution, using a flexometallic tube with an external malleable wire recently was described.2 Another approach was to use a preformed plastic tube, which extends the nasotracheal tube above the patient's forehead; this was described following an earlier design for pediatric nasal tubes.4 The use of preformed tubes has the disadvantage that the tube must fit the patient; consequently a set of several sizes must be available.

The introduction of the Bain Breathing Circuit® (The Kendall Company, Boston, Massachusetts) has facilitated the anesthetic management of head and neck surgery. This stimulated a search for a simpler technique to establish an extended connection between the breathing system and the nasotracheal tube.

METHOD

As a connector between nasotracheal tube and breathing system, we used a commercially available short (about 20 cm) noncuffed latex tube† with an imbedded nylon spiral,6 having an internal diameter of 7 or 7.5 mm. The tracheal end of this tube was fitted with an appropriate straight plastic endotracheal connector for later connection with the breathing circuit (fig. 1). The other end of the connecting tube, consisting of 3.5-cm long sleeve of un-inforced latex, was slipped over the end of a disposable plastic nasotracheal tube, which previously had been cut to a length of 23 to 26 cm, according to the size of the patient. The plastic tracheal tube was advanced into the latex sleeve until it reached the reinforcing nylon spiral. The assembly of nasotracheal tube and connector was 41–44 cm long. The pilot tube may be connected to a short iv extension set with a roller clamp; this extends the pilot tube past the connection with the breathing circuit and makes it accessible after the connection has been incorporated into the drapes.

With a nasotracheal intubation, the junction between the nasotracheal tube and the nylon imbedded latex tube was positioned just inside the nostril, however the junction could be advanced 2 to 3 cm further to adjust the fit of the nasotracheal tube. The other end of the connecting tube then was attached to a Bain Breathing Circuit® (fig. 2). This junction was positioned above the patient's forehead and readily could be incorporated into the head drape. In our experience the inclusion of the tube into a properly applied surgical head drape did anchor it securely, and no further tape fixation was needed. The use of an adhesive clear plastic film (Op-Site®), covering the upper half of the face and including the connecting tube, was favored by our surgeons.

In order to determine the resistance to flow, the nasotracheal tube with and without the described connector was attached to a T-piece whose side arm was connected to a water manometer. Various flow rates of nitrous oxide and oxygen at a ratio of 1:1 were generated with a blender and a suitable flow meter arrangement. Each flow was checked with a Collins Recording Spirometer, and all measurements were done in duplicate.

We have evaluated the described nasotracheal assembly clinically during the past 5 yr in regard to difficulty with endotracheal intubation, possible damage to nasal structures, tracheo-bronchial suction, the tolerance of spontaneous breathing, and the possibility of disconnection of the intranasal junction.

* Clinical Professor.
† Professor.
Received from the Department of Anaesthesia, University of Western Ontario, London, Ontario, Canada. Accepted for publication October 19, 1983.
Address reprint requests to Dr. Bain: Department of Anaesthesia, Victoria Hospital Corporation, P. O. Box 5375, London, Ontario, Canada N6A 4C5.
Key words: Equipment. Intubation: nasotracheal.
§ Smith and Nephew Inc., Lachine, Quebec H8T 2Y5.
RESULTS

The extension of the nasotracheal tube by 18 cm with a nylon embedded latex tube of 7 or 7.5 mm internal diameter increased the resistance to flow in the range of normal breathing (peak flows between 10 and 30 l/min) by 1 to 2 cmH₂O (fig. 3). The assembly with the smallest nasotracheal tube (6.5 mm ID) imposed a resistance of 5 cmH₂O at peak flow of 20 l/min. The volume of the connecting tube (7.5 mm ID) was 9.2 ml, about equal to the internal volume of a commonly used plastic elbow connector (8.8 ml).

We prefer nasotracheal intubation under direct vision, and the tube assembly did not create additional difficulty. Blind nasotracheal intubations were successful on several occasions.

The latex sleeve of the connector fitted tightly over the endotracheal tube; wetting of the surface made the connecting easier. The plastic nasotracheal tube must be pushed into the sleeve until it touches the nylon spiral in order to avoid the potential hazard of a kink at the junction. Once connected this connection could not be pulled apart. When stretched, the latex sleeve tightened around the plastic endotracheal tube; separation was only possible by pushing the latex off the plastic. In our clinical experience with more than 200 uses of this connector, we have not encountered a disconnection inside the nose.

Tracheobronchial toilet required a well-lubricated

---

**Fig. 1.** The plastic nasotracheal tube is connected to the nylon imbedded latex tube.

**Fig. 2.** Nasotracheal connector in place; the junction with the plastic nasotracheal tube is just inside the nostril while the connection to the Bain breathing system is beyond the patient's forehead outside the surgical field.

**Fig. 3.** Resistance to peak flows from 10 to 60 liters. The heavy lines represent values obtained with an unattached endotracheal tube, 6.5 mm ID (upper curve) and 7.5 mm ID (lower curve). The broken line represents the resistance of nasotracheal tube together with the connecting latex tube of the same internal diameter.
suction catheter, size 12 or 14 French, which must be at least 50 cm long to extend past the tip of the endotracheal tube.

At the end of surgery, particularly after maxillo-facial procedures, the nasotracheal assembly was left in place until the trachea could be extubated safely. For prolonged endotracheal intubations, a T-piece arrangement was attached to supply humidified oxygen enriched air. In some cases the tube was left in place for up to 48 hours; spontaneously breathing, conscious patients seemed to breathe quite comfortably with it. With the relatively small endotracheal tube and the connecting tube of about equal size, we have not observed adverse effects due to pressure exerted at the nasal alae or inside the nasal passages.

**DISCUSSION**

Nasotracheal intubation is the preferred approach to airway control for oral and maxillo-facial surgery and for plastic surgery about the lower part of the face.

The described extension of the nasotracheal tube by a nylon embedded latex tube combined with our lightweight coaxial breathing circuit provides for a flexible anesthetic system that can be incorporated readily into various surgical drapes. It offers virtually unimpeded access to the surgical field, while permitting the anesthetist to have access to the connection between nasotracheal tube and breathing circuit without disturbing the surgical field.

The nearly doubling in length of an airway of narrow diameter gives rise to concern about airway resistance. Although our measurement (fig. 3) may be considered near the limit of acceptability, we have found all the postoperative patients awake and breathing spontaneously, quite comfortable with this tube in place. Recent studies by Mooe et al. in our Department, demonstrated that patients breathing spontaneously under anesthesia adapt readily to considerably greater loads.7

There may be concern about the connection between the latex tube and the plastic tracheal tube, which is hidden inside the nasal passage. The 35-mm long latex sleeve makes a disconnection due to pull impossible. Kinking of the unforced latex portion of the connecting tube would be a potential hazard. We have not yet encountered this problem, always taking care that the plastic tube is advanced into the latex sleeve until it touches the reinforcing nylon spiral. The connection should be tested for kinking before insertion.

**REFERENCES**

1. Sporel WE, McFarlane RM: Anesthetic techniques for operations about the face. Anesthes Analg 45:170–175, 1966

Anesthesiology 60:499–503, 1984

---

**Hemodynamic Response to Diazepam: Dependence on Prior Left Ventricular End-diastolic Pressure**

**Paul J. Dauchot, M.D.,* Frank Staub, M.D.,† Ligitza Berzina, M.D.,‡ Daniel van Heeckeren, M.D.,§ Wilma Mackay, M.S.,§ Ramune Sirvaitis, R.N.†**

Diazepam has a relatively safe cardiovascular (CV) record. Circulatory stability usually is maintained after intravenous diazepam.1 Yet, occasionally substantial decreases in blood pressure (BP) and cardiac output have been reported,2 and significant CV depression has been observed when diazepam is used in association with narcotics.3 Since diazepam also is known to decrease left

---

* Professor, Department of Anesthesiology.
† Assistant Professor, Department of Anesthesiology.
‡ Assistant Professor, Division of Cardiothoracic Surgery.
§ Senior Instructor, Department of Biometry.
* Research Assistant, Department of Anesthesiology.
Received from the Departments of Anesthesiology, Cardiothoracic Surgery, and Biometry, Case Western Reserve University and University Hospitals, Cleveland, Ohio. Accepted for publication October

---

20, 1983. The preliminary results of this study were presented at the Meeting of Critical Care Medicine, St. Louis, 1982.
Address reprint requests to Dr. Dauchot: Department of Anesthesiology, Case Western Reserve University, 2074 Abington Road, Cleveland, Ohio 44106.
Key words: Anesthesia; cardiovascular. Heart: myocardial function; systolic time intervals. Hypnotics: benzodiazepines; diazepam.