

repaired fistula on extubation. We suggest that the tube be replaced by an ordinary endotracheal tube while the chest is still open. This will allow surgeons to inspect the suture line before closure.

Other alternatives for airway maintenance during repair are:

Single-lumen endobronchial tubes, e.g., MacIntosh-Leatherdale tubes.⁵ These can achieve same purpose as double-lumen tubes except for the fact that the right lung will be perfused and unventilated from the time of intubation until the chest is opened.

Use of a long ordinary endotracheal tube to intubate the left bronchus. This presents the same drawbacks as MacIntosh-Leatherdale tubes. It also is more difficult to introduce because it lacks appropriate curvatures. It is often not long enough to lodge securely in the left bronchus.¹

SUMMARY

The problems and anesthetic management of the surgical repair of a tracheoesophageal fistula 1.5 cm. above the carina are discussed. It is suggested that use of a left bronchial double-lumen tube, such as the Robertshaw tube, provides a secure airway and ensures adequate ventilation.

REFERENCES

1. Killen, D. A., and Collins, H. A.: Tracheoesophageal fistula resulting from non-penetrating trauma of the chest, *J. Thorac. Cardio. Surg.* 50: 104, 1965.
2. Cardwell, J. L.: The anesthetic management and problems in the closure of a traumatic tracheoesophageal fistula in an adult (case report), *ANESTHESIOLOGY* 7: 317, 1946.
3. Stephens, T. W.: Traumatic tracheo-esophageal fistula following steering-wheel type of injury, *Brit. J. Surg.* 52: 370, 1965.
4. Robertshaw, F. L.: Low resistance double-lumen endobronchial tubes, *Brit. J. Anaesth.* 34: 576, 1962.
5. MacIntosh, R. R., and Leatherdale, R. A. L.: Bronchus tube and bronchus blocker, *Brit. J. Anaesth.* 27: 556, 1955.

Nasal Intubation in Mandibular Prognathism: Postnasal Obstruction and Management

H. D. WESTGATE, M.D., J. R. GORDON, M.D., J. S. RYDBERG, M.D.*

Difficulties in placing a nasotracheal tube may be caused by anatomical abnormalities at any point from the external nares to the trachea. Partial obstruction of the positioned nasotracheal tube may occur at the time of placement or subsequently because of changes in the position of the patient's head and neck. Surgical manipulation may also cause partial or total airway obstruction.

The following case is an example of total obstruction of a nasotracheal tube by an anatomical abnormality in the region of the palatopharyngeal arch.

CASE REPORT

A 21-year-old woman was admitted to the hospital for surgical correction of mandibular prognathism. She was classified as an A.S.A. I risk, and the surgeons proposed to perform bilateral subcondylar osteotomies. At 6:00 A.M. on the day of surgery 125 mg. secobarbital (Seconal) and 125 mg. hydroxyzine (Vistaril) were administered intramuscularly. In the operating room the blood pressure was 130/90 mm. Hg, pulse rate 85 per minute. Following intravenous administration of 0.6 mg. atropine, anesthesia was induced with 425 mg. thiopental sodium (Pentothal) and 68 mg. gallamine triethiodide (Flaxedil), given as a mixture containing 25 mg. thiopental and 4 mg. gallamine per ml. A 10.7 mm. I.D. red rubber Murphy tube was inserted through the right nostril into the oropharynx and then, under direct vision, directed into the trachea with the aid of Magill's

* Department of Anesthesiology, University of Minnesota Medical School, Minneapolis, Minnesota.

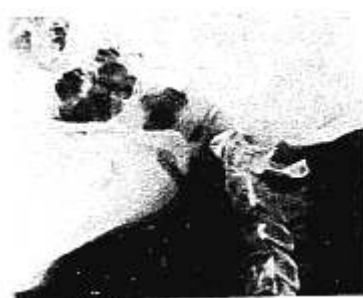


FIG. 1. Orthodontic lateral X-ray of the patient's skull showing narrowing of the palatopharyngeal arch due to posterior projection of the soft palate, anterior projection of the anterior tubercle of the atlas, and a reversed lordotic curve of the cervical vertebrae.



FIG. 2. Orthodontic lateral X-ray of the skull showing the normal anatomical relationships of the anterior tubercle of the atlas, the soft palate, and the 20-year-old woman.

forceps. The cuff on the nasotracheal tube was inflated and ventilation of the patient's lungs was attempted.

Tremendous pressure was required to inflate the lungs partially, and no noticeable expiration occurred. The cuff on the nasotracheal tube was deflated, the nasotracheal tube rotated, and the Sierra directional valves in the anesthetic circuit exchanged, without lessening of the obstruction. The nasotracheal tube was removed and its lumen inspected, but no obstruction was found. Ventilation of the patient's lungs was easily carried out via face mask and semi-open anesthetic system. A 10-mm. I.D. red rubber Murphy tube then was inserted through the right nostril. The tube's progress was momentarily arrested in the posterior

nasopharynx, but with the aid of a rotary motion it passed into the oropharynx and by means of Magill's forceps and a laryngoscope it was directed into the trachea. Ventilation of the patient was achieved with only slightly less inspiratory pressure than the first time, and expiration was so prolonged that a respiratory rate of 8 per minute was required to allow complete emptying of the lungs. The patient's trachea was extubated and an unsuccessful attempt was made to insert a 10-mm. I.D. armored tube through the external naris. Since a smaller armored tube was not available, the procedure was abandoned and the patient was returned to the postanesthesia recovery room. She awakened quickly and complained of a sore throat and a congested nose. Dexamethasone (Decadron), 4 mg., was administered intravenously as prophylactic therapy for laryngeal edema, and naphazoline (Privine), 0.05 per cent solution was prescribed for nasal congestion.

X-rays of the cervical vertebrae and skull (fig. 1), reviewed with a radiologist and an orthodontist, showed loss of the normal lordotic cervical curve, a prominent anterior tubercle of the atlas pointing towards the palate rather than parallel with the base of the skull, and an elevated, posteriorly-positioned palate, resulting in a very small entrance to the oropharynx.

With these findings in mind, the patient was re-scheduled for surgery the following day so that an attempt could be made with a smaller armored nasotracheal tube. (Failing this, oral intubation of the trachea would have been done. This would introduce considerable hazard, however, for after extubation the teeth would be approximated with rubber bands or wires as is necessary following bilateral subcondylar osteotomies, and the patient would be semiconscious.) The next day an 8.7-mm. I.D. cuffed armored tube was inserted through the left nostril into the trachea. The subsequent anesthetic course was satisfactory. At the end of surgery the patient's jaws were wired in position by intermaxillary fixation and she was sent to the recovery room with the nasotracheal tube in place. A lateral X-ray of the skull was made, the patient given 3 mg. phenazine (Trilafon) intravenously, and the nasotracheal tube removed. The patient was discharged on the third postoperative day after an uneventful postanesthetic course.

DISCUSSION

Nasotracheal intubation, since its introduction by Magill and Rowbotham,¹ has done much to advance surgical treatment of the head and neck. The gentle curve² that the nasotracheal tube follows as it passes from the external naris into the trachea was recognized by these men and utilized in the manufacture of the Magill, as well as other, endotracheal tubes.

In the unanesthetized patient the upper fibers of the palatopharyngeus muscles pull on their posterior pharyngeal wall insertions (Passavant's bar), and may prevent the passage of a nasotracheal tube.³ Vellacott believes that a prominent anterior tubercle of the atlas or the hollow above it is the commonest cause of obstruction in the posterior nasopharynx. He states that passage of the tube into the oropharynx may be assisted by sweeping the index finger upward behind the soft palate and dislodging the tip of the tube from the anterior tubercle of the atlas. The other hand may then advance the nasotracheal tube into the oropharynx.⁴

Passage of the nasotracheal tube into the trachea of our patient was not difficult. Momentary resistance in the posterior nasopharynx was easily overcome, but complete obstruction to air flow resulted when the trachea was intubated. The narrowed palatopharyngeal arch, prominent anterior tubercle of the atlas, and resultant acutely-angled entrance to the oropharynx caused the obstruction of the nasotracheal tube.

The lordotic curve of the cervical spines was reversed in this patient (fig. 1), and the distance between the base of the skull and the posterior tubercle of the atlas was smaller than normal. An anteriorly-projected line drawn through the posterior and anterior tubercles of the atlas lies parallel to the base of the skull and at some distance above the soft palate in the normal person (fig. 2). In our patient the line passed through the soft palate. Because of these deviations from normal, the anterior

tubercle was much more prominent and its anterior projection narrowed the palatopharyngeal arch. In addition, the palatopharyngeal muscle pulled the soft palate posteriorly to almost touch the anterior tubercle of the atlas (Passavant's bar). In the normal patient (fig. 2) the posterior border of the soft palate ends at the last upper molar and leaves a wide space between the palate and Passavant's bar, through which a nasotracheal tube may be passed with ease.

Although abnormalities of the palate and palatopharyngeal area are recognized by orthodontic surgeons and used by them in the classification of mandibular prognathism, they are not widely recognized by anesthesiologists. Preoperative X-rays of the area, readily available from orthodontists, should be reviewed by the anesthesiologist. If the anterior tubercle of the atlas is prominent, or the distance between the soft palate and tubercle is small, a selection of armored and firm nasotracheal tubes in different sizes should be readily available to facilitate intubation.

REFERENCES

1. Rowbotham, E. S., and Magill, I. W.: Anaesthetics in the plastic surgery of the face and jaws, *Proc. Roy. Soc. Med. (Anaesth.)* 14: 17, 1921.
2. Gillespie, N. A.: *Endotracheal Anesthesia*. Third edition. University of Wisconsin Press, 1963, pp. 102, 105.
3. Townshend, R. H.: The formation of Passavant's bar, *J. Laryng.* 55: 154, 1940.
4. Vellacott, W. N.: Nasal intubation: Some post-nasal obstructions and how they may be overcome, *Brit. J. Anaesth.* 34: 115, 1962.