

CORRESPONDENCE

Anesthesiology
 2000; 92:913-8
 © 2000 American Society of Anesthesiologists, Inc.
 Lippincott Williams & Wilkins, Inc.

From Something Old Something New

To the Editor:—My attention was recently drawn to a newly designed oral airway¹ with an inflatable cuff (fig. 1) developed from one first described by Greenberg and Toung of the Johns Hopkins Hospital in Baltimore in 1992. Something familiar about this airway prompted me to search through my files, and I found an airway with an inflatable cuff² for intranasal surgery (fig. 2). This had been introduced by Sir Francis Shipway, senior anesthetist at Guy's Hospital, in 1935.³ A somewhat similar Lessinger airway cuff (fig. 3) was found in the 1936 Foregger catalogue. Sir Francis introduced his airway as "a simple method of preventing blood, pus, or other fluid from entering the trachea during intranasal operations." For this, the airway carried a rubber balloon, with a tube for its inflation when *in situ*. The mouth was then packed with ribbon gauze. Nitrous oxide and oxygen could then be administered through the airway by means of the special fitting,³ which was designed not to interfere with the manipulations of the surgeon (fig. 4).

Neither Sir Francis nor Langton Hewer mentioned that this fitting had been designed by Ivan Magill in 1922 while he was working at the Queen's Hospital for Facial and Jaw Injuries in Sidcup. Magill and Rowbotham had been appointed as anesthetists to this hospital on a part-time basis to handle their 600 ex-service patients with maxillofacial injuries, although until then, Magill had scant knowledge of anesthetics. Pallister⁴ stated that Magill recalled that initially, the anesthetic equipment available to them was limited to a Shipway apparatus,⁵⁻⁷ with which they insufflated ether vapor through an oral airway, but the difficulty of maintaining the airway throughout an operation, which lasted some 4 h and sometimes entailed the entry of blood into the pharynx, was a tremendous job. For this task, "the slot in the Philips pharyngeal airway was fitted with an angle piece made from a 303 cartridge case" (fig. 4). Ether vapor from the Shipway apparatus was blown into a funnel attached to this angle piece. The funnel magnified the patient's breath sounds and so enabled the anesthetist to follow the patient's breathing while well away from the surgical field. A later improvement on Magill's anglepiece that could be rotated was introduced by Charles in 1937 (fig. 5).⁸ Until the international 15-mm fitting was later adopted, British tracheal tube connectors followed Magill's design and used a short length of rubber tubing to connect with the breathing system.

Rowbotham^{5-7,9} and Magill progressed from this early method to an endotracheal insufflation technique using two tubes. One, a narrow bore gum-elastic catheter, was passed through the nose and guided into the trachea using a laryngoscope and a rod inserted into an eye at the end of the catheter. This tube conveyed the gases deep into the trachea. The other, wider bore tube was passed through the other nostril into the pharynx to ensure a free exit for the gases. It was noticed that occasionally this tube would glide spontaneously into the larynx. Magill^{10,11} developed this technique and introduced it as "blind intubation" in 1928. In the days before relaxants, this was a great convenience because it enabled one to intubate at planes of anesthesia too light to provide adequate relaxation for laryngoscopy.

In addition to his part-time post at the maxillofacial center, Magill joined the staff of the Brompton Hospital for Consumption in 1923 and was appointed Chloroformist to the Westminster Hospital in 1924. At the Brompton Hospital, he worked on the equipment necessary to solve the problems of anesthesia for thoracic surgery, evolving endobronchial tubes and blockers and the instruments necessary for their placement.⁵⁻⁷



Fig. 1. The cuffed oropharyngeal airway (COPA; Mallinckrodt Inc.). Note the location of the cuffs at the lower end of the airways except on Sheffer's. On the COPA, the use of modern materials has made possible an improved cuff profile to provide an airtight seal with the tongue.



Fig. 2. The first cuffed oropharyngeal airway for intranasal operations. (Reprinted with permission.³)

Further perusal of Hewer's 2nd Edition² revealed yet another surprise: a diagram of Primrose's¹² cuffed oropharyngeal "throat tube" (fig. 6). This was designed to ensure a gas-tight breathing system for his new carbon dioxide absorption apparatus, which incorporated two other unique features. It used concentrated caustic soda solution as the absorbent in what we would now call a Bain or Mapleson D breathing system. Interestingly, a refined version of the Bain system has recently been introduced for carbon dioxide absorption (King Systems Universal F2 Circuit).

Primrose's throat tube was a surprise because it forecast the design of tubes described by Mehta in 1990 (fig. 7),¹³ Green and Akesther in 1981 (fig. 8),¹⁴ and Feldman *et al.* in 1991 (fig. 9).¹⁵ However, although Mehta's and Feldman's airways bore a striking resemblance to that of Primrose, the stimulus for their efforts, like Brain's,¹⁶ was to develop something unlike a face mask to provide "hands off" control of the airway without the need for tracheal intubation. Although both Mehta and Feldman were satisfied with the functioning of their airways, neither was put onto the market by the manufacturer, who also declined to produce Bain's laryngeal mask airway. Mehta retired before the field trial was completed, and the manufacturer's trial of Feldman's nasotracheal airway showed an unacceptable epistaxis rate.

Another early design was Leech's patented "pharyngeal bulb gasway" of 1937 (fig. 10).^{17,18} Instead of an inflatable cuff, this used a

resilient soft rubber bulb on the metal pharyngeal airway to press into the base of the tongue to effect a seal.

On December 1, 1970, Marcus B. Sheffer of Wayne County, MI, was granted U.S. Patent #3,543,751 on a design for an oral airway with an inflatable cuff (fig. 11). However, unlike the others, its cuff was designed to be distended within the mouth to hold the patient's cheeks in engagement with the face mask for artificial respiration. Apparently, it never went into production.

What could have stimulated Primrose and Leech to design cuffed oral airways? (1) at that time in the mid-1930s, their hospitals' finances would have been severely strained by the Great Depression, making economy essential; (2) cyclopropane, a new gas then being introduced, described by Magill as a "Godsend" in thoracic anesthesia was, however, both expensive and explosive; (3) a gas-tight closed carbon dioxide absorption system was thus essential; (4) but most anesthetists were not skilled in the use of the straight bladed laryngoscopes then available; (5) in the absence of relaxants, surgery would often have to be delayed until a deep enough plane of anesthesia was obtained to provide the relaxation necessary for laryngoscopy.

"Doubtless the patience of many a surgeon was sorely tried on a busy operating day by the first attempts of his anaesthetist"¹¹ to intubate a patient. Skill with Magill's blind nasal method of intubation no doubt saved many an anaesthetist's reputation. Failing that, could Shipway's cuffed oral airway have been the solution?

Hewer seems to have had some reservations about its intended use:



Fig. 3. The Lessinger airway cuff from the 1936 Foregger catalogue. (Courtesy Richard Foregger, M.D.)

CORRESPONDENCE

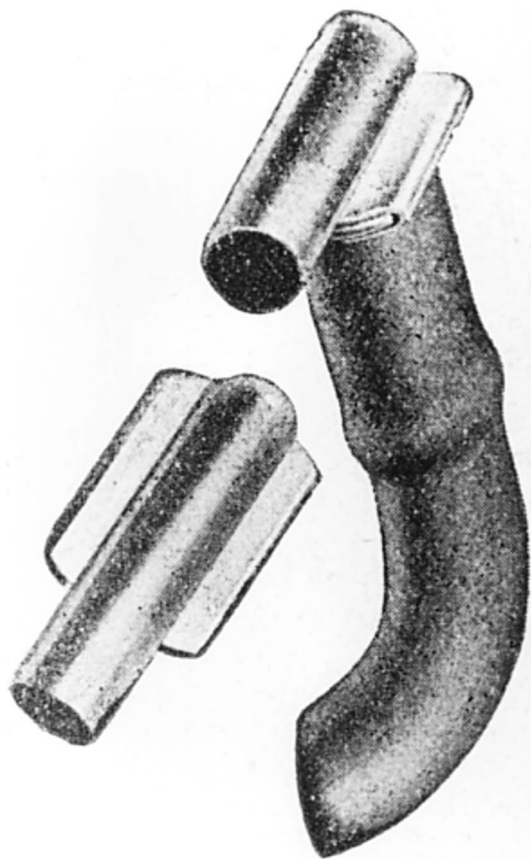


Fig. 4. Magill's airway angle piece made from a 303 rifle cartridge in 1922. (Reprinted with permission.³)

If it is impossible to administer endotracheal anaesthesia for intranasal operations, a fairly efficient substitute is an airway fitted with an inflatable balloon combined with a gauze pack. Too much attention cannot be paid to the exclusion of fluids from the larynx and trachea. There is no doubt that the routine use of suction and of endotracheal anaesthesia with adequate packing for nasal and oral operations has diminished the incidence of postoperative pulmonary complications.²

Factors leading to the disuse of these cuffed airways included the following: (1) availability of endotracheal intubating equipment: During World War II, the British government provided the emergency medical service hospitals in Britain with endotracheal equipment, and U.S. Army hospitals were equipped with endotracheal sets containing endotracheal tubes, connectors, and a Guedel folding laryngoscope specifically designed for endotracheal intubation; (2) anesthesiologists who were skilled in laryngoscopy and blind nasal intubation became available; the Armed Forces trained large numbers to give anaesthesia and to intubate either with a laryngoscope or *via* the blind nasal method, either of which would better assure the airway than a cuffed pharyngeal airway; (3) in 1942, curare commenced to be used in anaesthesia, and 1951 saw the introduction of succinylcholine, thus eliminating the problem of inadequate relaxation.

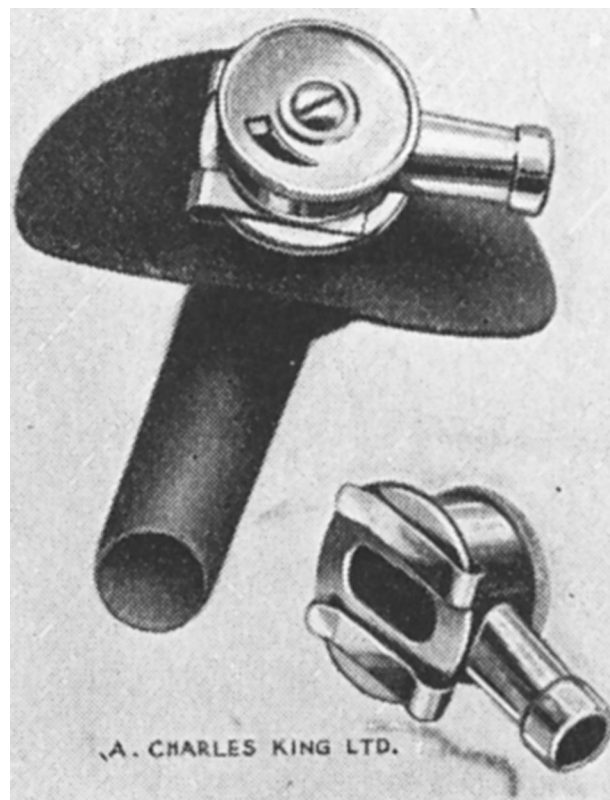


Fig. 5. Charles' anaesthetic airway cap, 1937. (Reprinted with permission.⁸)

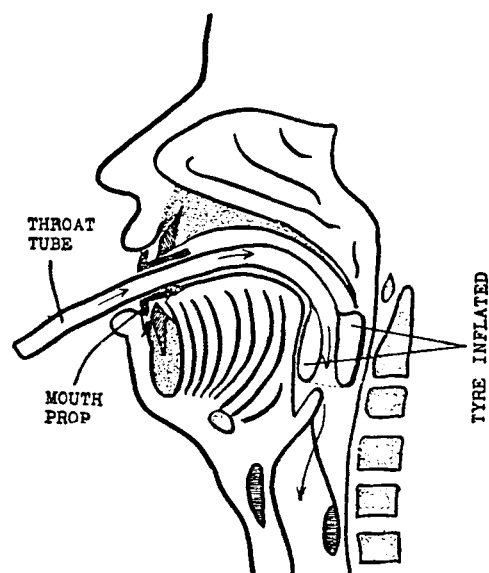


Fig. 6. Primrose's cuffed oropharyngeal throat tube in position. (Reprinted with permission.¹²)

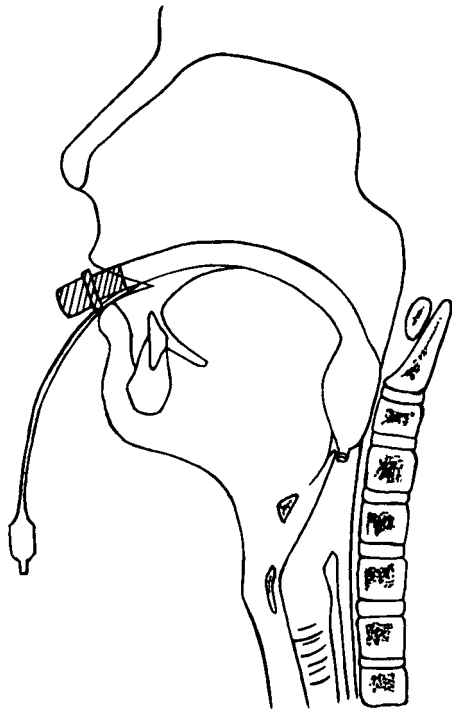


Fig. 7. The supraglottic oropharyngeal airway described by Mehta.¹³ Initially, Mehta used a laryngoscope to place his tube but later learned to insert it blindly. It was never marketed. (Reprinted with permission.¹³)

An era then gradually developed when nearly all patients were intubated. The younger anesthesiologists became uncomfortable administering anesthesia with a face mask, and the feeling developed that not to intubate was a sign of sloppy practice, and if anything went wrong, it would be difficult to defend against a charge of malpractice.

At the present time, we have returned to the problems of the 1930s, with hospitals stressing their tight budgets, "fast tracking" to save time between cases, eliminating time spent in recovery, more ambulatory cases, and patients now undergoing surgery in surgeons' offices. Coincident with this, we have the latest group of excellent agents in each category. Many are much superior to their predecessors, but all are much more expensive.

The answer has been to return to some aspects of the "pretube era," using light planes of anesthesia, avoiding laryngeal intubation, avoiding using relaxants, and, because many are not comfortable using a face mask, using a laryngeal mask airway or cuffed oropharyngeal airway. Although skill with Magill's blind nasal intubation method is now rare,¹⁹ it has been replaced by skill with the fiberoptic laryngoscope. This, combined with a cuffed laryngeal or pharyngeal airway, can provide a solution for the most difficult airway problems.^{20,21}

Fortunately, these new items of equipment come fitted with international standard 15-mm connectors, originally called "catheter slip joints" by Richard von Foregger, who first manufactured them. He also supplied nonbreathing valves and other pediatric breathing system components, each item equipped with these 15-mm fittings in a male-to-female sequence starting with the male tracheal tube connector at the patient. The dimensions of these conical fittings and this male-to-

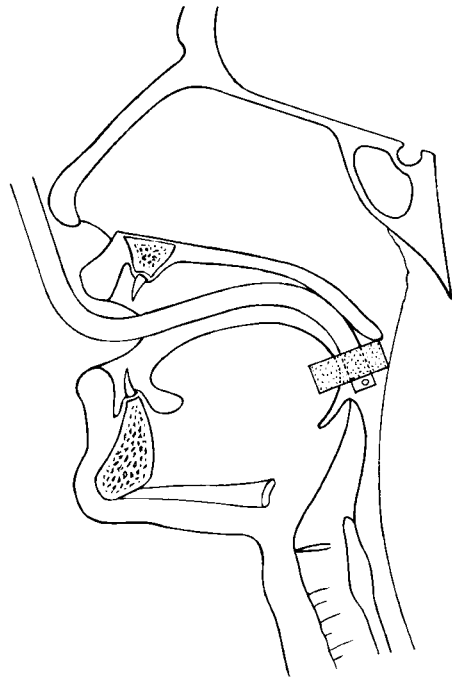


Fig. 8. Green and Akesther's combined oropharyngeal airway and dental pack, 1981.¹⁴ (Reprinted with permission.¹⁴)

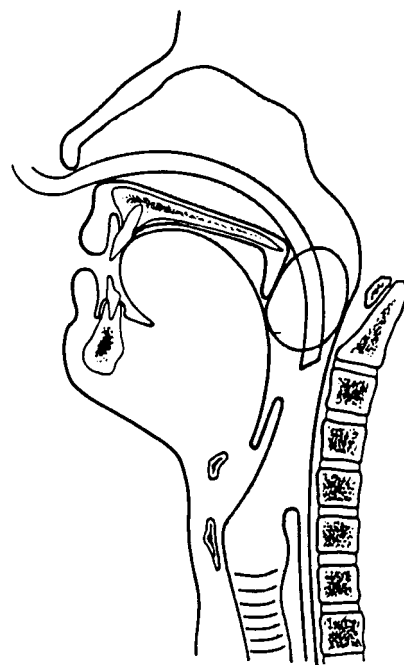


Fig. 9. Feldman *et al.*'s cuffed nasopharyngeal airway, 1991. This size 7 cuffed nasal tube was produced to satisfy a wide range of needs after major head and neck surgery. It was introduced as a disposable alternative to the laryngeal mask airway that would be stable once inserted. (Reprinted with permission.¹⁵)

CORRESPONDENCE

female sequence were the first items adopted by the original American Society of Anesthesiologists-sponsored American National Standards Institute Sectional Committee Z79, toward an international pediatric anesthesia breathing system standard in the late 1960s. The adoption of standard 15- and 22-mm fittings made possible the introduction of the first disposable anesthesia breathing systems by Roberts and Mahon in 1968.²²

Since 1983, the United States and international anesthesia equipment standards have been maintained and updated by Committee Z79's successor, the American Society for Testing and Materials Committee F29. It is gratifying to see that today's anesthesiologists have lost none of the pioneers' resourcefulness in devising practical solutions to their everyday clinical problems and are making good use of the superior materials now available.

Leslie Rendell-Baker, M.D., F.R.C.A.
Emeritus Clinical Professor of Anesthesiology
Loma Linda University School of Medicine
Department of Anesthesiology
Loma Linda, California 92350
rendell@earthlink.net

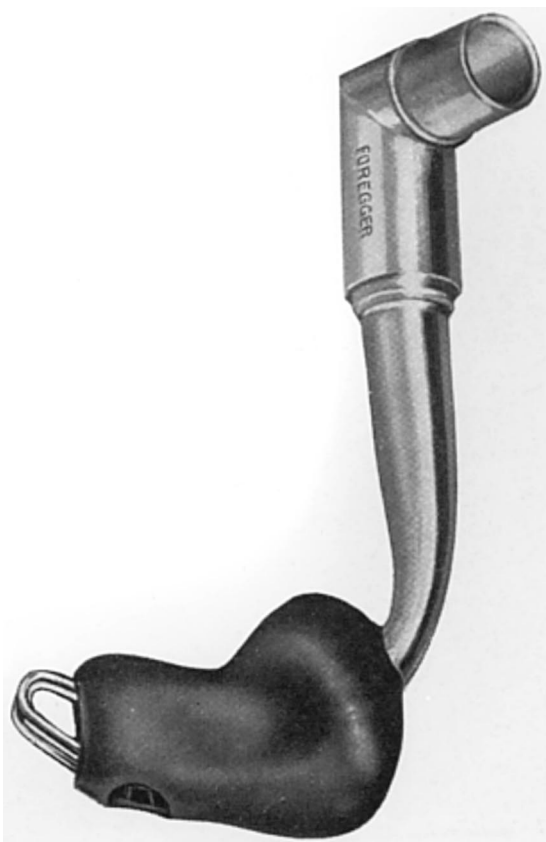


Fig. 10. Leech's pharyngeal bulb gasway, 1937 (Foregger catalogue).

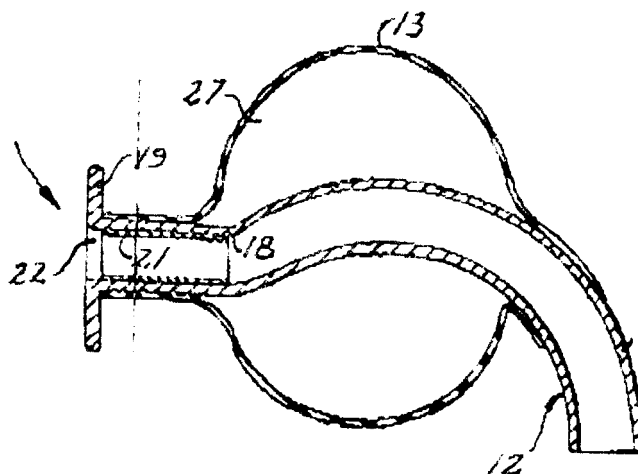


Fig. 11. Patent illustration of Sheffer's oral airway, 1970. Unlike the other airways, Sheffer placed his cuff in the mouth at the upper end of the airway, so that when inflated, it held the cheeks firmly against the mask during resuscitation. (Accepted for publication November 15, 1999.)

References

1. Greenberg RS, Brimacombe J, Berry A, Gouze V, Piantadosi S, Dake EM: A randomized controlled trial comparing the cuffed oropharyngeal airway and the laryngeal mask airway in spontaneously breathing anesthetized adults. *ANESTHESIOLOGY* 1998; 88:970-7
2. Hewer CL: *Recent Advances in Anaesthesia*, 2nd Edition. London, Churchill, 1937, pp 187-8
3. Shipway F: Airway for intranasal operations. *Br Med J* 1935; 1:767
4. Pallister WK: Sir Ivan Whiteside Magill (1888-1986) and tracheal intubation, *The History of Anaesthesia*. Edited by Atkinson RS, Boulton TB. London, Royal Society of Medicine, 1989, pp 605
5. Mushin WW, Rendell-Baker L: Shipway's insufflation apparatus, *The Origin of Thoracic Anaesthesia*. Park Ridge, IL, Wood Library—Museum of Anesthesiology, 1991, p 76
6. Mushin WW, Rendell-Baker L: Rowbotham's two catheter method, *The Origin of Thoracic Anaesthesia*. Park Ridge, IL, Wood Library—Museum of Anesthesiology, 1991, pp 124-5
7. Mushin WW, Rendell-Baker L: Magill's endotracheal and endobronchial tubes and scopes, *The Origin of Thoracic Anaesthesia*. Park Ridge, IL, Wood Library—Museum of Anesthesiology, 1991, pp 131-3
8. Charles H: An anaesthetic airway cap. *Br Med J* 1937; 1:449
9. Rowbotham S: Intratracheal anaesthesia by the nasal route for operations on the mouth and lips. *Br Med J* 1920; ii:590-1
10. Magill IW: Endotracheal anaesthesia. *Proc R Soc Med* 1928; 22:83-8
11. Magill IW: Technique in endotracheal anaesthesia. *Br Med J* 1930; ii:817-9
12. Primrose WB: The "recovery principle" in gas-oxygen anaesthesia. *Br Med J* 1934; 1:339-43, 478-80
13. Mehta S: A supra-glottic airway. *Anaesthesia* 1990; 45:893-4
14. Green RA, Akether J: A combined oropharyngeal airway and dental pack. *Anaesthesia* 1981; 36:889-91

CORRESPONDENCE

15. Feldman S, Fauvel N, Ooi R: The cuffed pharyngeal airway. *Eur J Anaesth* 1991; 8:291-5
16. Brain AIJ: The laryngeal mask: A new concept in airway management. *Br J Anaesth* 1983; 55:801-4
17. Leech BC: The Pharyngeal Bulb Gasway: A new aid in cyclopropane anesthesia. *Anesth Analg* 1937; 16:22-5
18. Leech BC: Pharyngeal Bulb Gasway. U.S. Patent #2,099,127. November 16, 1937
19. Chandra P: Blind intubation. *Br J Anaesth* 1966; 38:207-11
20. Hawkins M, O'Sullivan E, Charters R: Fiberoptic intubation using the cuffed oropharyngeal airway and Aintree intubation catheter. *Anaesthesia* 1998; 53:891-4
21. Asai T, Matsumoto H, Shingu K: Awake insertion of the cuffed oropharyngeal airway for nasotracheal intubation. *Anaesthesia* 1999; 54:492-3
22. Rendell-Baker L: The care of anesthesia equipment, Principles and Practice of Nurse Anesthesia. Edited by Waugaman WR, Rigor BM, Katz LE, Garde JF, Bradshaw HW. Norwalk, Appleton-Lange, 1988, p 102

(Accepted for publication November 15, 1999.)