

---

# **Emergency Airway Management**

---

Gorback

## A General Approach

---

### A. Administer oxygen.

1. The **awake, spontaneously breathing** patient who is ventilating well does not require assistance at this point.
2. **Assisted ventilation** with a bag and mask may be started in the obtunded or compromised patient, even if there is spontaneous respiration.
  - a. **Synchronize** assisted ventilation with the patient's respiratory efforts.
  - b. **Assisting ventilation** in the awake patient **will reduce stress and anxiety** by reducing air hunger, hypoxemia, and hypercarbia.

### B. Assess the patient.

History, physical examination, radiographic evaluation, and laboratory data will help determine the urgency and preferred means of airway management.

### C. Plan.

Well thought out, deliberately executed management will succeed more often than frenzied flailing.

#### 1. Anticipate problems.

- a. A **backup plan** should be formulated in case the primary plan fails.
- b. **Proper equipment** should be at hand.

#### 2. Review the possible routes for airway control.

- a. Oral
- b. Nasal
- c. Retrograde
- d. Fiberoptic
- e. Surgical

#### 3. Review the possible ways to provide optimum conditions.

- a. Sedation
  - b. Anesthesia
  - c. Paralysis
  - d. **Regional anesthesia** (e.g., nerve blocks, topical anesthesia)
-

**Publisher**

**B.C. Decker Inc**  
3228 South Service Road  
Burlington, Ontario L7N 3H8

**B.C. Decker Inc**  
320 Walnut Street  
Suite 400  
Philadelphia, Pennsylvania 19106

**Sales and Distribution**

*United States and Puerto Rico*  
**Mosby-Year Book Inc.**  
11830 Westline Industrial Drive  
Saint Louis, Missouri 63146

*Canada*  
**McGraw-Hill Book Ltd.**  
5240 Finch Ave. E., Unit 1  
Scarborough, Ontario M1S 5A2

*Australia*  
**McGraw-Hill Book Company**  
**Australia Pty. Ltd.**  
4 Barcoo Street  
Roseville East 2069  
New South Wales, Australia

*Brazil*  
**Editora McGraw-Hill do Brasil, Ltda.**  
rua Tabapua 1.105, Itaim-Bibi  
Sao Paulo, S.P. Brazil

*Colombia*  
**Interamericana/McGraw-Hill de Colombia, S.A.**  
Apartado Aereo 81078  
Bogota, D.E. Colombia

*Europe*  
**McGraw-Hill Book Company GmbH**  
Ladenmannbogen 136  
D-2000 Hamburg 63  
West Germany

*France*  
**MEDSI/McGraw-Hill**  
6, avenue Daniel Lesueur  
75007 Paris, France

*Hong Kong and China*  
**McGraw-Hill Book Company**  
Suite 618, Ocean Centre  
5 Canton Road  
Tsimshatsui, Kowloon  
Hong Kong

*India*  
**Tata McGraw-Hill Publishing Company, Ltd.**  
12/4 Asaf Ali Road, 3rd Floor  
New Delhi 110002, India

*Indonesia*  
P.O. Box 122/JAT  
Jakarta, 1300 Indonesia

*Italy*  
**McGraw-Hill Libri Italia, s.r.l.**  
Piazza Emilia, 5  
I-20129 Milano MI  
Italy

*Japan*  
**Igaku-Shoin Ltd.**  
Tokyo International P.O. Box 5063  
I-28-36 Hongo, Bunkyo-ku,  
Tokyo 113, Japan

*Korea*  
C.P.O. Box 10583  
Seoul, Korea

*Malaysia*  
No. 8 Jalan SS 7/6B  
Kelana Jaya  
47301 Petaling, Jaya  
Selangor, Malaysia

*Mexico*  
**Interamericana/McGraw-Hill de Mexico, S.A. de C.V.**  
Cedro 512, Colonia Atlampa  
(Apartado Postal 26370)  
06450 Mexico, D.F., Mexico

*New Zealand*  
**McGraw-Hill Book Co. New Zealand Ltd.**  
5 Joval Place, Wiri  
Manukau City, New Zealand

*Panama*  
**Editorial McGraw-Hill Latinoamericana, S.A.**  
Apartado Postal 2036  
Zona Libre de Colon  
Colon, Republica de Panama

*Portugal*  
**Editora McGraw-Hill de Portugal, Ltda.**  
Rua Rosa Damasceno 11A-B  
1900 Lisboa, Portugal

*Singapore and Southeast Asia*  
**McGraw-Hill Book Company**  
21 Neythal Road  
Jurong, Singapore 2262

*South Africa*  
**Libriger Book Distributors**  
Warehouse Number 8  
"Die Ou Loolery"  
Tannery Road  
Hamilton, Bloemfontein 9300

*Spain*  
**McGraw-Hill/Interamericana de Espana, S.A.**  
Manuel Ferrero, 13  
28020 Madrid, Spain

*Taiwan*  
P.O. Box 87-601  
Taipei, Taiwan

*Thailand*  
632/5 Phaholyothin Road  
Sapan Kwai  
Bangkok 10400  
Thailand

*United Kingdom, Middle East, and Africa*  
**McGraw-Hill Book Company (U.K.) Ltd.**  
Shoppenhangers Road  
Maidenhead, Berkshire  
SL6 2QL England

*Venezuela*  
**McGraw-Hill/Interamericana, C.A.**  
2da. calle Bello Monte  
(entre avenida Casanova y Sabana Grande)  
Apartado Aereo 50785  
Caracas 1050, Venezuela

**NOTICE**

The authors and publisher have made every effort to ensure that the patient care recommended herein, including choice of drugs and drug dosages, is in accord with the accepted standards and practice at the time of publication. However, since research and regulation constantly change clinical standards, the reader is urged to check the product information sheet included in the package of each drug, which includes recommended doses, warnings, and contraindications. This is particularly important with new or infrequently used drugs.

Emergency Airway Management

ISBN 1-55664-143-5

© 1990 by B.C. Decker Incorporated under the International Copyright Union. All rights reserved. No part of this publication may be reused or republished in any form without written permission of the publisher.

Library of Congress catalog card number: 90-80933

10 9 8 7 6 5 4 3 2 1

## **Contributors**

---

**Edmond C. Bloch, M.D.**

Associate Professor of Anesthesiology  
Assistant Professor of Pediatrics  
Duke University Medical Center  
Durham, North Carolina

**Michael S. Gorback, M.D.**

Assistant Professor of Anesthesiology  
Assistant Professor of Surgery  
Duke University Medical Center  
Durham, North Carolina

**J. Michael Plavcan, Ph.D.**

Department of Biological Anthropology and Anatomy  
Duke University  
Durham, North Carolina

**Charles B. Watson, M.D., F.A.C.A., F.C.C.M.**

Chairman, Department of Anesthesiology  
Bridgeport Hospital  
Bridgeport, Connecticut

**To Page and Caitlin**  
*The two lights of my life*

## Foreword

---

Dr. Gorback's book uniquely addresses the requirements of proper positioning and maintenance of an artificial airway. A properly positioned artificial airway can allow effective ventilation to be delivered to the patient who has lost spontaneous ventilatory capabilities. It can permit positive airway pressure to be used to maintain alveolar stability in the patient who is hypoxemic. It can offer a certain degree of aspiration protection in the patient who has lost upper airway reflexes. However, proper positioning and maintenance of an artificial airway necessitate a skilled professional, especially in emergency situations. Such a professional needs to have a solid understanding of airway anatomy and physiology, the appropriate psychomotor skills for airway insertion, and the judgment and the knowledge to use special techniques and pharmacologic adjuncts as necessary.

The focus of this book is broad with topics ranging from basic airway anatomy and equipment to circumstances that can be faced in emergency situations. Dr. Gorback is an experienced anesthesiologist and an effective teacher of both physicians and allied health personnel in the principles of airway management. The book is logically arranged, heavily illustrated, clinically oriented, and loaded with the "pearls" one needs to provide high-quality airway care.

NEIL R. MACINTYRE, M.D.  
Associate Professor of Medicine  
Medical Director of Respiratory Care  
Duke University Medical Center  
Durham, North Carolina

## **Foreword**

---

In the past 10 years, there has been a resurgence of interest in the functional anatomy of the airway, in improving endotracheal tubes with low pressure cuffs, in redesigning rigid laryngoscopes, and in vastly improved flexible fiberoptic instruments. With improvements in the technical aspects of laryngoscopy and intubation, younger anesthesiologists must learn and older anesthesiologists must update their knowledge to stay abreast of the field.

Dr. Gorback's book provides a method of gaining a lucid overview of the subject. While the text offers a comprehensive outline of the topic, his clever dissections and photographs clearly demonstrate how a variety of laryngoscopes, airways, endotracheal tubes, and instruments interact with the patient's airway to facilitate endotracheal intubation.

JAMES T. ROBERTS, M.D.  
Assistant Professor of Anesthesia  
Harvard Medical School  
Associate Anesthetist  
Massachusetts General Hospital  
Boston, Massachusetts

## Preface

---

The attention given to specific emergency situations and detailed information concerning the use of drugs and regional anesthesia distinguish this book from other airway management books. I began this work in response to a perceived need. In 1985, I started the Emergency Airway Management Service, Department of Anesthesiology, at Duke University Medical Center. My goal was to provide an organized service—based on 24-hour availability of experienced senior anesthesia residents—to aid in emergency airway management throughout the hospital. One of the early problems encountered was the residents' discomfort with this role. This might seem unusual since these were individuals with hundreds of intubations under their belts. My first reaction was to reassure them that most of their encounters were likely to be straightforward intubations. All they needed to do was follow the principles they learned in the Operating Room.

Then I remembered my own trepidation when cast in the same role during my training at Massachusetts General Hospital. I recalled carrying all sorts of paraphernalia, such as a 12 gauge catheter for performing needle cricothyroidotomy, or a No. 4 MacIntosh blade. What I couldn't intubate with a "Mac 4," I reasoned, I could briefly support with the 12 gauge. Most of all, I remembered combing the literature, filled with anticipatory anxiety, seeking a good source of information on how to handle



uncommon situations. Eagerly I plunged into any material whose title included the words "difficult" and "airway" only to find myself searching in vain for the magic section entitled "What to Do If . . . , " which I envisioned sandwiched between "What to Look For . . ." and "How Much to Give and When . . . ."

Thoroughly self-chastised by these reminiscences, I put together a small booklet of typewritten notes and photocopied illustrations that I thought the residents might find useful. This compendium consisted of descriptions of mask airway management, intubation techniques, drug dosages and adverse effects, nerve blocks, and so on. The state of the book remained unchanged until 1988, when I was approached by Dr. Philip Lumb to write a chapter on management of the difficult airway for the series "Problems in Respiratory Care." Dr. Lumb's enthusiastic reaction to the finished product encouraged me to contact a gentleman I happened to meet a few years before, Dana Dreibelbis, presently Vice President of B.C. Decker. Mr. Dreibelbis, equally enthusiastic, encouraged me to expand my little in-house publication into a formal handbook. I am almost ready to forgive him.

Thus began a 2-year obsession/labor of love. As work progressed I began to understand why so little tangible material was available concerning emergency airway situations: very little is *known*. Sure, there are many *recommendations*, but there are few published series. Most of what is written is opinion, not conclusions drawn from scientific study. One cannot perform prospective, randomized studies of emergency airway situations in the same manner as aspirin prophylaxis for myocardial infarction. For example, the management of the patient with cervical spine trauma, a common problem, is a hotbed of controversy, as perusal of the bibliography of Chapter 9 confirms. If you like the controversy surrounding the proper approach to breast cancer, you'll love reading about emergency airway management.

Illustration was the second major problem encountered during preparation of the manuscript. A frequent criticism of previous works concerning airway management is the use of line art instead of photography. My colleagues and I have endeavored to rely on photography as much as possible, using color where

appropriate (even though it increases the cost of publication dramatically). The most difficult pictures to shoot are those of greatest interest to the novice: views of the larynx at laryngoscopy. The lighting conditions are abysmal; because one is shooting down into a hole, one cannot simply use a flash. I even tried wearing a headlight. Using high-speed film with a wide lens aperture, shooting off the light of the laryngoscope yielded a slightly grainy picture with shallow depth of field. I believe that these pictures, limited as they are, still represent an improvement over line art.

The cadaver pictures, on the other hand, were a joy to shoot, confirming my impression that medical education should run in reverse: first, do clinical medicine, *then* go back and learn basic science—it suddenly has a new relevance that was missing the first time around. For this reason I believe that other experienced intubators will enjoy the pictures in this book, perhaps more so than the text, which brings me to the last point I wish to make.

Opinion, conjecture, and personal experience are unavoidably woven into the fabric of this book to fill some rather large gaps. There are many ways to manage an airway, and I'm certain that despite sincere efforts to do justice to all schools of thought there will be those who disagree with what my colleagues and I present here. Nonetheless, I believe this book will serve the reader well as a reference book and, more importantly, a conceptual framework for emergency airway management. In summary, this book is for anyone, anywhere, anytime, who ever stood at the bedside of patient in need of airway intervention and asked, "Now what do I do?" Or plans to. . . .

## **Acknowledgments**

In any organization there are individuals behind the scenes without whom life would be very difficult. One such person is Mr. Joe Zawadowski, the Person Who Makes Things Happen in the Anatomy Lab. Much of the prosection seen in the photographs in this book could not have been done without his help.

I am indebted to Dr. Joseph Moyland and Mr. Kevin Fitzpatrick

for their help in preparing the section on airway burns and for photographs pertaining to airway burns. I also wish to thank Dr. William Fulkerson for providing pictures taken during bronchoscopy. Dr. Herman Grossman and Ms. Frances Apple were very helpful in procuring most of the radiographs reproduced herein. Drs. Richard Moon and L. Clayton Andrews performed the supreme sacrifice: reviewing the entire manuscript.

Ms. Rebecca McLaughlin kindly posed for the oxygen mask and mask airway management pictures. The able hands of Drs. Diane Scott and Timothy Quill appear in certain illustrations of airway management and intubation. Dr. William Greeley provided thoughtful insights and suggestions.

Finally, I wish to express my sincere appreciation to Drs. Roger Wilson, James Roberts, Colin MacKenzie, and Baek Hyo Shin, whose dedication to teaching the art of airway management had a major impact on my own practice.

MICHAEL S. GORBACK, M.D.

- 
- D. Topical anesthesia, nerve blocks, and sedation** can then be administered.
- 1. Sedation** should be carefully titrated so that unconsciousness can be slowly induced and halted or reversed (if narcotics were used) if it is not possible to control the airway with bag and mask.
  - 2. Do not obtund the patient or produce paralysis** unless it is reasonably certain that the airway can be controlled.
- E. If sedation progresses to the point of unconsciousness** (which may occur after a surprisingly small amount of drug in the exhausted patient), laryngoscopy may be attempted.
- F. If control of the airway can be demonstrated** by successful *controlled* ventilation with bag or mask, a muscle relaxant may be given to facilitate intubation. It is preferable to use a muscle relaxant with few hemodynamic side effects, such as vecuronium.
- G. If initial attempts at intubation fail**, assess what went wrong and try something different.
- H. Persevering under suboptimal conditions will often make things worse** by causing trauma and bleeding. Do not wrestle with a struggling patient; back off and obtain better conditions.
- I. Use awake intubation** when in doubt. Consider transportation to the operating room, especially in the presence of certain conditions, such as epiglottitis or stridor.
- J. Don't be proud.** Send or ask for help sooner rather than later. Don't fight over who will perform airway management. Relinquish control to the most experienced person present.
-

---

# **Emergency Airway Management**

---

**Michael S. Gorback, M.D.**

Assistant Professor of Anesthesiology  
Assistant Professor of Surgery  
Duke University Medical Center  
Durham, North Carolina

---

**B. C. Decker Inc.**

**Philadelphia • Toronto**

# Contents

---

## One

### **Applied Airway Anatomy 1**

J. Michael Plavcan, Ph.D., and Michael S. Gorback, M.D.

## Two

### **Equipment 9**

Michael S. Gorback, M.D.

## Three

### **Assessment 27**

Michael S. Gorback, M.D.

## Four

### **Basic Airway Management 39**

Michael S. Gorback, M.D.

## Five

### **Advanced Airway Management 51**

Michael S. Gorback, M.D.

## Color Plates

Six

**Fiberoptic Intubation 89**

*Charles B. Watson, M.D., F.A.C.A., F.C.C.M., and Michael S. Gorback, M.D.*

Seven

**Pediatric Airway Management 101**

*Edmond C. Bloch, M.D., and Michael S. Gorback, M.D.*

Eight

**Adjunctive Techniques 127**

*Michael S. Gorback, M.D.*

Nine

**Specific Pathophysiologic States 149**

*Michael S. Gorback, M.D.*

**Index 179**

---

# One

## **Applied Airway Anatomy**

J. Michael Plavcan, Ph.D., and Michael S. Gorback, M.D.

---

### **I. Mouth and Mandible (Figs. 1-1 and 1-2)**

#### **A. Oral cavity**

1. **Dental.** The teeth and alveolar arches comprise the rigid boundaries of the mouth anteriorly and laterally.
  - a. **Loose teeth** may be dislodged during laryngoscopy.
  - b. **Protruding teeth** are more likely to be dislodged or damaged. In addition, they frequently make laryngoscopy difficult.
- c. **Prostheses**
  - i. **Removable prostheses**, such as dentures, may be dislodged during airway management, causing airway obstruction, impeding laryngoscopy, or both.
  - ii. **Masks** for ventilatory support are designed for the typical facial physiognomy and **often fit the edentulous patient poorly**. Therefore, some practitioners leave dentures in the mouth to obtain a better mask fit. However, an oral airway can provide approximately normal facial contours should the need for better fit arise and is less likely than dentures to be dislodged into the pharynx.
2. The **tongue** and mucosa below it constitute the inferior wall of the oral cavity.
  - a. **Innervated by several cranial nerves**, the tongue is usually anesthetized topically.





**Figure 1-1.** Sagittal section of the head. A, Brain; B, frontal sinus; C, cribriform plate; D, superior concha; E, sphenoid sinus; F, nostril; G, inferior concha; H, eustachian tube orifice; I, palate; J, teeth; K, tongue; L, uvula; M, mandible; N, posterior wall of pharynx; O, epiglottis; P, vertebral column; Q, spinal cord.

- b. A large tongue will hinder the performance of laryngoscopy.
- c. Anterior muscular attachments to the mandible and hyoid bone often lose tone in the unconscious patient, allowing the tongue to fall back and cause airway obstruction.