

*Comprehensive Management of
Swallowing Disorders*

Second Edition

Comprehensive Management of Swallowing Disorders

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Foreword

Welcome to the second edition of *Comprehensive Management of Swallowing Disorders*. This textbook provides one of the most comprehensive works on dysphagia that the world has ever seen.

If you are fortunate to live long enough, it is likely that you or someone you love will develop a swallowing disorder. The disability caused by dysphagia can be physically and emotionally devastating. Some have likened the suffering to a perpetual state of being water boarded. Our patients with dysphagia, however, are resilient and remarkably courageous in their fight to restore dignity to a life that has been radically altered.

Although there has been great advance in swallowing diagnostics, there has been little progress in the management of profound dysphagia. This second edition textbook addresses a fundamental

knowledge gap and provides the dysphagia clinician with a comprehensive foundation for which future treatment innovation can be made.

I would like to thank the editors and contributors for their tireless effort, consummate devotion, and enduring passion in the completion of this work. Your dedication is infectious and provides the catalyst for future progress.

We must take advantage of the opportunity provided by this work to disrupt the stagnation in translational research for swallowing disorders. Complacency is not an option. For those of us who do battle in the clinic, on the ward, in the operating room, and in the lab, let us redouble our efforts to innovate, raise awareness, and make a difference. Vitalize your sense of innovation and THINK BIG. The time is now.

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Preface

The first edition of *Comprehensive Management of Swallowing Disorders* was published in 1999 by Singular Publishing Group. When Singular was sold, the new company retained the contract. The text continued to sell despite the lack of active marketing. Eventually, the authors (R.L.C., T.M.) successfully reacquired the rights to the book. A second printing by Plural Publishing Incorporated in 2006 resulted in continued strong interest in the book.

The continued interest in the first edition was the stimulus to produce this new and updated edition. Drs. Carrau and Murry were fortunate to be joined by Rebecca Howell, MD as a coeditor. Dr. Howell brings a new enthusiasm to the book and a new group of dysphagia specialists to the second edition. With several authors from the first edition and the addition of new authors, the editors have updated each section of the book. This edition represents the broad interests of the medical, surgical, and behavioral specialists who treat swallowing disorders. The authors bring their research and teaching expertise to the contents of the revised book. The second edition of *Comprehensive Management of Swallowing Disorders* is both a clinical reference as well as a textbook for all specialists involved in dysphagia teaching and clinical care.

Clinicians who pioneered work in dysphagia are the impetus for the second edition of this text. From the time when swallowing was taken for granted to the present day, research in every aspect of eating, chewing, swallowing, nutrition, and quality of life has advanced the rehabilitation of patients with swallowing problems. The treatment of swallowing disorders continues to grow as a medical specialty and a science and is no longer overlooked in the overall management of patients suffering from disorders such as a stroke, cancer, and other acute or chronic catastrophic diseases. We have seen the changes in clinical pathways that have occurred in major medical centers to improve the rehabilitation of patients through the efforts of those who treat swallowing.

It is because of the ever-evolving changes in the management of swallowing disorders and the inevitable and necessary interaction with all the many specialists who treat swallowing disorders that we

elected to revise the original text and represent all the specialties that manage dysphagia. Our experience, gained after a number of years working in a multidisciplinary environment, studying swallowing both in the normal and disordered populations, is that swallowing problems are complex even when the diagnosis is known. Moreover, our philosophical approach is that swallowing is not the domain of only speech pathologists or the medical or surgical specialists. Rather, it is in the best interest of the patients suffering from a swallowing disorder that all clinicians involved in their care be active participants in their rehabilitation.

This second edition of *Comprehensive Management of Swallowing Disorders* addresses the swallowing problems from the point of view of all those specialists in medical, surgical, and rehabilitative medicine who are involved in the management of these patients. We feel that each discipline must understand each other's role in the management of swallowing disorders. Central to that notion is the understanding of the normal swallow. We have devoted a considerable number of pages to the normal pediatric and adult swallow, including a detailed discussion of the anatomy, physiology, and pathophysiology of swallowing. The clinician who understands the anatomy, physiology, and neurology of normal swallowing will better understand the effects of diseases, disorders, and functional changes that present as swallowing disorders. We have revised all of the chapters and invited 77 authors who are currently in the forefront of dysphagia management, research, and teaching.

This text is divided into seven sections. In the first section, an introduction to the myriad of swallowing disorders is presented. A vast array of conditions that are associated with swallowing disorders and their epidemiology are introduced.

Part II describes the anatomy and physiology of swallowing. Both the organs of swallowing and the normal swallow are reviewed in detail. "The Normal Swallow," written by Dr. Howell, updates the latest understanding of normal swallowing physiology.

Part III addresses the evaluation of swallowing from seven perspectives: otolaryngology, speech

pathology, pediatrics, gastroenterology, neurology, physical and rehabilitative medicine, nutrition, and surgery. Each specialist describes the clinical evaluation and procedures that he or she uses when first evaluating a patient with a swallowing problem. Although some of these techniques are similar among all and, therefore, the text may appear to be repetitive, each discipline provides a unique perspective on the aspects important for making a diagnosis and planning treatment.

Part III also includes chapters on various tests of swallowing function. These include the various radiographic examinations, endoscopic tests of swallowing, gastroenterology tests, and electromyography. The benefits and disadvantages, along with the complications, of each test are described.

Part IV contains 18 chapters that cover all aspects of the pathophysiology of swallowing disorders. This section of the text is a "tour de force" of medical, surgical, and neurological problems that lead to swallowing disorders; the identifying signs and the disorders; and, in some chapters, case studies of management. The detail with which this section of the book is assembled reflects the strong multidisciplinary nature of the entire text.

Part V is devoted to the nonsurgical treatment of swallowing disorders. Four chapters are devoted

to diet modification, behavioral techniques, prosthodontics, and swallowing management of adults with tracheotomies. Each chapter includes methods and procedures for each stage of swallow rehabilitation. Nonsurgical rehabilitation of swallowing has advanced from the early trials to a functional framework of treatment based on the swallowing disorder.

Part VI reviews the surgical treatments of swallowing disorders. These chapters are devoted to the various surgical procedures that are both temporary and permanent treatments for laryngeal, pharyngeal, esophageal, and gastric disorders.

Part VII addresses swallowing problems in special populations. Special problems of the pediatric population are addressed, as well as problems of critical care patients, aging patients, terminally ill patients, and patients with intractable aspiration pneumonia. A final chapter discusses future trends in the management of dysphagia.

We are indebted to the many specialists who have taken time to address swallowing from a multidisciplinary perspective. Their commitment to this text reflects the commitment that they profess to the diagnosis and treatment of swallowing disorders. Each contributor has kept the focus of this text in mind when addressing his or her specific topic.

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To my wife Silvia and my daughters Didi, Lori, and Catarina for your steadfast support and love; to all professionals who during the past three decades have advanced the field of dysphagia to the forefront of medicine; and to my patients, who continue to endure my best efforts to care for them.

—Ricardo L. Carrau

To Marie-Pierre, who through her love and understanding has supported my professional goals, and to Nicholas, whose energy, enthusiasm, and challenges make the journey worthwhile. And to all of our patients who continue to teach us.

—Thomas Murry

To my husband, John, who afforded me years of writing and decades of support. To my sister, Rachel, for leaning in. Finally, thank you Lord for not letting me forget; you are the Great Physician.

—Rebecca J. Howell

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PART I

INTRODUCTION

The Introduction offers a brief summary of the current literature regarding the incidence and prevalence of swallowing disorders in various patient populations. Data regarding swallowing disorders are evolving rapidly. As more disciplines are becoming aware of the significance of swallowing disorders, it may be expected that epidemiology studies will continually change our concepts on these issues. Factors affecting the different populations most commonly afflicted by swallowing disorders are highlighted in this section.



Epidemiology of Swallowing Disorders

*Thomas Murry
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The consequences of inhaling various substances into the bronchi and lungs provide a subject for interesting study and vital importance for many patients. Bronchopneumonia is one of these consequences.

— J. B. Amberson, 1937

INTRODUCTION

The preceding quote introduced Amberson's landmark treatise on aspiration. The statement is still as relevant today. Amberson clearly saw the importance and significance of aspiration in most aspects of a medical practice and rehabilitation, since aspiration bronchopneumonia may turn the tide unfavorably, when otherwise recovery would be expected.¹

The prevalence of dysphagia is unknown, but epidemiologic studies indicate that the numbers may be as high as 22% of the population over 50 years of age. Several studies conclude that between 300 000 and 600 000 individuals in the United States are affected by neurogenic dysphagia each year.² The number of individuals affected by other causes of

dysphagia—cancer, gastroesophageal reflux, and surgical procedures—is difficult to measure but is at least another 100 000. Ten million Americans are evaluated each year for swallowing difficulties. The true incidence of dysphagia in the general population remains unknown, as many cases come to light only after an acute or significant medical incident that might not otherwise call attention to dysphagia.

The evaluation and management of patients with swallowing dysfunction have evolved into a major clinical activity for many disciplines in the medical community. Despite the prolific scientific and clinical findings presented in the past 20 years, the study of dysphagia remains an inexact science. We are still pursuing the goals that Amberson eloquently outlined more than 70 years ago, namely, the circumstances under which dysphagia occurs, the management of the case after it does occur, and, especially, the possibilities and means of prevention.

In this chapter, the epidemiology of dysphagia is presented. Although epidemiology refers to both prevalence and cause, this chapter focuses primarily on prevalence, as causes are covered throughout the text.

*Original chapter on this topic by Thomas Murry, PhD, Ricardo L. Carrau, MD, and David E. Eibling, MD.

PREVALENCE OF DYSPHAGIA AND ASPIRATION

Dysphagia is a common comorbidity associated with a wide variety of disease states and is often associated with illnesses that result in anatomical abnormalities or neuromuscular dysfunction of the oral cavity, pharynx, larynx, and esophagus. Dysphagia due to primary esophageal disease is not rare but is not encountered as frequently as is oropharyngeal dysphagia.^{3,4} Any illness that results in weakness, either from specific neurological or muscular pathology or from generalized debilitation, is likely to have dysphagia related to it.

Stroke Patients

Brain injury due to stroke is one of the most common causes of dysphagia. Stroke is the third most common cause of death in the US each year, with approximately 500 000 new cases reported annually and an estimated 150 000 individuals dying from stroke each year. Between 30% and 40% of stroke victims will demonstrate symptoms of significant dysphagia, and as many as 20% will die from aspiration pneumonia in the first year.⁴ More recently, Jani and Gore reported that dysphagia was diagnosed in 55% of all patients with neurological diseases including stroke.⁵ A prospective study of stroke victims suggests that there is a 50% incidence of aspiration in this group of patients.⁶ Moreover, half of those patients who aspirate do so silently, without obvious symptoms or clinical findings.⁷ As a result, the quoted figure of 30% may be a low estimate due to the frequency with which aspiration occurs without clinical signs in many stroke patients.⁸

Although the correlation of site and size of a stroke with subsequent dysphagia is variable, the trend is that the larger the area of infarction, the greater the impairment of swallowing. In general, brainstem strokes produce dysphagia more frequently and more severely than cortical strokes.⁹ Robbins et al suggest that the severity of dysphagia in patients with left hemisphere strokes seems to correlate with the presence of apraxia, and the reported deficits are more significant during the oral stage

of swallowing.¹⁰ Patients with strokes affecting the right hemisphere have more pharyngeal dysfunction, including aspiration and pharyngeal pooling.

Although recovery of neuromotor functions following stroke is unpredictable, dysphagia, with its attendant risk of aspiration, decreases over time in most patients. Unfortunately, many patients do not recover sufficient neuromuscular function to safely tolerate a regular diet, placing them at risk for the potentially fatal consequences of aspiration. Thus, in addition to the 20% of stroke victims who die of aspiration pneumonia in the first year following a stroke, approximately 10% to 15% of stroke victims die of aspiration pneumonia in the years following the stroke.¹⁰

Nursing Home Residents

The population residing in nursing homes is increasing. In 1985, 5% of the US population over the age of 65, and 22% of the population over the age of 85 years, resided in nursing homes.¹¹ Studies carried out in nursing homes have demonstrated that 30% to 40% of the residents have clinical evidence of dysphagia, and the prevalence of pneumonia has been estimated to be 2%.¹²

Moreover, autopsy studies have demonstrated that there is a failure to diagnose pneumonia in this population in as many as 27% of cases.¹³

A prospective study of 152 nursing home patients followed for 3 years by Feinberg and coworkers revealed 55 episodes of pneumonia, defined as a new infiltrate persisting for more than 5 days.¹³ During the first year, one third of these 55 patients were found to demonstrate major aspiration of clinical significance and one-third minor aspiration of no significance, and one-third did not aspirate on initial examination with videofluoroscopy. After 3 years, a total of 90 of the 152 patients developed pneumonia and 41 expired over the 3-year period of the study. Pneumonia was considered to be the cause of death in 27 of those who expired, or 18% of the original 152 patients.

In another surveillance study, following the population of 13 nursing homes with a total of 1754 residents, Beck-Sague et al found an incidence of pneumonia of 27% during a 6-month period.¹⁰

Although it is not clear how many of these infections were secondary to aspiration, the data obtained from other studies suggest that the incidence is extremely high.

Pneumonia in the nursing home population is associated with a higher mortality than community-acquired pneumonia or any other infection.¹³ The mortality rate for patients admitted to acute care hospitals from nursing homes with pneumonia has been reported to be 40%, compared with patients with community-acquired pneumonia, which was 28%. Patients with pneumonia admitted from nursing homes constituted 14% of all cases admitted with the diagnosis of pneumonia.¹⁴ Although it is unknown how many of these patients developed pneumonia as a result of aspiration, there is general consensus that as many as 70% to 90% of elderly patients, even those without known neurological disease, have some degree of swallowing dysfunction, if not true dysphagia.

One can assume, therefore, that due to the large number of patients with dysphagia residing in nursing homes, the total number of admissions of nursing home patients to acute care hospitals for aspiration-induced pneumonia is significant. It is estimated that a typical nursing home of 120 beds can expect to transfer one patient per month to an acute care hospital for the treatment of pneumonia. Therefore, each year in the United States approximately 250 000 nursing home patients require hospitalization for pneumonia. The cost of acute care hospitalization for management of these patients with pneumonia had been estimated to be about \$20 000 per patient. The cost of the treatment of this complication, in most cases probably due to aspiration, is estimated to exceed \$3 billion each year in the US alone.^{15,16} The actual costs are probably even higher, considering treatment for patients who are not admitted or for the isolation of patients who develop infections with resistant organisms from the antibiotic therapy required for the management of pneumonia.

Dementia and Dysphagia Patients

Dysphagia is common in elderly patients with dementia. Feinberg demonstrated normal swallowing function in only 9 of 131 (7%) patients with

dementia studied with videofluoroscopy.¹⁶ Nearly one-third of the patients (30%) were restaged following examination, demonstrating the inaccuracies of routine history and physicals in this patient population. His study demonstrated not only the high percentage of clinically significant dysphagia in this population, but also pointed out the difficulties in assessing this group of patients because of their dementia, as well as the ineffectiveness of therapeutic maneuvers that require patient cooperation.

Hospitalized Patients

Nosocomial pneumonia occurs in a significant percentage of Medicare patients hospitalized for other, unrelated illnesses. Mortality is estimated at between 20% to 50% in these patients, and the average increase in hospital cost due to nosocomial infection was estimated to be \$5800 per hospitalization in 1991.¹⁷ This number has increased to over \$15 000 in 2012.¹⁸ In many instances, this increase raised hospitalization costs significantly above the reimbursement received from Medicare for the care given. It can be safely assumed that this cost differential has increased in the years since this study; hence, it is likely that the cost of treating nosocomial pneumonia, many cases of which are probably due to aspiration, is a significant factor in health care costs and, ultimately, profitability for hospitals and managed health care plans. Despite the significant costs of medical care generated by patients with aspiration, there is remarkably little emphasis on the evaluation and management of these patients, and reimbursement for the time required for evaluation and treatment is so low as to discourage physician involvement in all but a few major institutions with an academic commitment to the study and management of dysphagia.

The incidence of swallowing disorders in patients admitted to critical care units is increased by the need for endotracheal and nasogastric intubation, tracheotomy, and use of sedatives, along with impaired consciousness and the debilitated status of many of the patients requiring critical care. These and many other factors predispose these patients to aspiration of oral secretions, food, and gastric refluxate. The incidence of pneumonia in the ICU,

however, is not necessarily higher than in the general hospital population, perhaps due to the skill and intensity of nursing care, which can obviously alter the outcome in patients with swallowing disorders.

Valles et al¹⁹ prospectively followed 77 patients requiring mechanical ventilation. The incidence of ventilation pneumonia episodes was 39.6/1000 ventilation days. He found that in another group of 76 patients whose subglottis was being continuously aspirated, the incidence was 19.9/1000 ventilation days, demonstrating the importance of aspiration as an etiology for pneumonia and the therapeutic implications of suctioning the aspirate.

Normal Elderly Population

Many apparently normal elderly patients suffer from chronic dysphagia. As many as 50% of elderly patients have difficulty eating that leads to nutritional deficiencies with associated weight loss, increased risk of falling, poor healing, and increased susceptibility to other illnesses associated with weakness.²⁰ *Sarcopenia*, or “loss of flesh,” is considered the major challenge of the geriatric population²¹ and is undoubtedly related to decreased caloric intake. Multiple factors are thought to be responsible for this reduced oral intake, including loss of teeth, reduced oral sensitivity, changes in taste and smell, decreased hand-eye coordination, vision loss, solitary eating, and depression.²² Difficulties with mobility lead to a reduced ability to live independently, limiting going out to buy groceries or even selecting a proper diet. It has been demonstrated that the degree of sarcopenia correlates well with serum albumin levels, which is strongly correlated with nutritional status.²³ Recent studies also have demonstrated that caloric requirements for the elderly are surprisingly high, and often not met by dietary intake.²⁴ Therefore, it is intuitive that a major cause of sarcopenia is related to inadequate caloric intake from self-imposed dietary restriction related to chronic dysphagia.

Although much of the recent literature has addressed exercise and activity levels, there has been surprisingly little emphasis on nutritional factors and the role of dysphagia. Moreover, the weakness associated with muscle atrophy further increases the degree of dysphagia due to further reduction in effectiveness of swallowing function.

Head and Neck Oncology Patients

Head and neck squamous cell carcinoma represents 4% of all malignancies and comprises 95% of all the malignant tumors arising within the upper aerodigestive tract. Approximately 65 000 new cases are diagnosed every year, accounting for 12 000 deaths a year. The presence of tumor in the upper aerodigestive tract may affect swallowing by mechanical obstruction due to bulk or extraluminal compression, decreased pliability of the soft tissue because of neoplastic infiltration, direct invasion of nerves leading to paralysis of important pharyngeal or laryngeal muscles, or pain.

Virtually all treatments for head and neck cancer result in a temporary or permanent swallowing problem. Treatment for squamous cell carcinoma, namely surgery and radiation therapy, produces disabilities that are usually proportional to the volume of the resection and/or the radiation field. Surgery produces division and fibrosis of muscles and anesthetic areas due to the transection or extirpation of afferent neural fibers and/or receptors. This is most evident in patients who require resection of large oropharyngeal tumors in which the swallowing reflex or the “trigger” of the pharyngeal swallow will be delayed or absent or in patients who undergo a supraglottic laryngectomy, in whom the loss of supraglottic and pharyngeal sensation almost invariably leads to aspiration. Radiation therapy leads to xerostomia, which in many cases is permanent and a primary source of patient complaints. Irradiation produces fibrosis of the oropharyngeal and laryngeal musculature. Furthermore, many patients presenting with large tumors will require combination therapy using both surgery and radiation therapy, which results in severe restriction of motion due to the consequences already mentioned. Recent trends toward the use of conservation protocols using chemotherapy and radiation seem to yield similar problems, with even more fibrosis of the soft tissues. D’Antonio reported the quality of life and functional status measurements of patients with squamous cancer of the head and neck demonstrating that 69% of these patients have some problems associated with swallowing.²⁵

Murry et al reported on acute and chronic changes in swallowing and quality of life following an intra-arterial chemoradiation protocol.²⁶

They found that quality of life and swallowing are related during the acute phase of treatment and early post treatment. However, the strongest relationship between swallowing and quality of life was found at 6 months post chemoradiation, pointing out the importance of swallowing function following chemoradiation. Swallowing function was most severely degraded in patients with oropharyngeal tumors. The researchers also found that swallowing improved significantly 6 months after chemoradiation, compared with pretreatment values.

More recent studies suggest that even with salivary gland sparing intensity-modulated radiation therapy (IMRT), swallowing function remains degraded in at least 50% of patients up to 10 years post treatment.^{27,28} Swallowing function appears to be related to both site and stage of disease. The degree of impairment is related to the dose as well as the location and size of the tumor. Quality of life may be further impaired by lack of postradiation treatment for trismus and diet management.

In general, patients with so-called anterior tumors, such as floor of the mouth or oral tongue, have better posttreatment outcome regarding swallowing than patients with so-called posterior tumors, such as oropharynx or hypopharynx. This is not to say that patients with oral tumors have no problems swallowing, as the oral phase is definitely affected.²⁹ These patients usually compensate by exhibiting piecemeal swallowing or clearing swallows.

As stated before, the greater the extent of resection, the greater the ensuing disability, especially if the resection involves areas with motor or sensory function that are critical for swallowing. Patients undergoing hemilaryngectomy have been found to recover their swallowing function sooner than patients undergoing supraglottic laryngectomies, who, in turn, recover much more quickly than patients undergoing extended supraglottic laryngectomy (extended to the base of the tongue).³⁰

List et al reported a prospective study following patients with carcinoma of the larynx.³¹ The post-radiation patients recovered swallowing function more quickly than the postsurgical patients. Sixty percent of patients treated with standard radiation at 6 weeks follow-up, and 80% at 12 weeks follow-up, demonstrated normal swallowing.

A study by Naudo et al of patients after supracricoid laryngectomy with cricohyoidoepiglottopexy

(CHP) demonstrated that 98.4% of their patients had what they described as “normal swallowing.”³² These patients recovered in a manner similar to post-radiation patients described by List, 68% of whom demonstrated a normal diet after the first month, but the authors report that 23% of these patients had grades 1–2 aspiration during this first month. At 1 year follow-up, 8.5% of these patients suffered aspiration pneumonia, and 0.5% required a total laryngectomy.

The method of reconstruction has also been implied in swallowing problems. Logeman et al found that patients with reconstruction by primary closure have the least problem swallowing.³³

Finally, swallowing therapy can alter the rehabilitation progress and swallowing outcome. Pauloski et al have demonstrated that patients undergoing oropharyngeal cancer surgery do not improve progressively between 1 and 12 months.³⁴ The postoperative swallowing status at 3 months reflected their swallowing status at a follow-up of 1 year after surgery. These authors suggested that this may be related to the relative lack of therapy that patients receive during the postoperative period between 3 to 12 months.

The following chapters will examine swallowing from the perspective of various healthcare providers. Detailed analyses of swallowing function as well as treatments are outlined in the various sections of this book. It is clear from the epidemiology that a broad team of specialists are involved in the diagnosis, treatment, and management of dysphagia depending on the origin of the disorder.

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