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## Chapter 4

# Swallowing

Patient Safety and Medicinal Therapy for  
Ear, Nose, and Throat Disorders

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According to current predictions, 16.4 percent of individuals in the United States will be over the age of 65 by 2020, making them the fastest-growing segment of the population (U.S. Census Bureau, 1996). The presence of health problems in our aging population is also increasing, with 80 percent of individuals over the age of 65 having at least one chronic illness. The incidence of dysphagia in this aging population is expected to have a significant impact on health care costs and quality of life.

Swallowing is a highly coordinated process involving four phases—oral preparatory, oral, pharyngeal, and esophageal—allowing for the manipulation of a bolus in the oral cavity and safe passage through to the stomach. In the normal swallow, this process is rapid and dynamic involving the functional integration of these phases, which permits passage of liquids and solids without incident from the oral cavity to the stomach. Dysphagia is then any difficulty in the process of deglutition or disruption in any of the phases. Aspiration results when there is misdirection of oropharyngeal or gastric contents into the larynx and lower respiratory tract. The most serious

outcome of the misdirected bolus is the development of aspiration pneumonia. The risk of aspiration pneumonia is greater in individuals with other risk factors including comorbidities of other medical illnesses, which are known to be more common in the elderly.

The exact incidence of dysphagia in the aging population is not known, although numerous studies have looked at specific aspects of its prevalence. Loeb and colleagues reported a 44 percent incidence of dysphagia in the elderly that was associated with significant morbidity and mortality. Groher and McKaig looked at the prevalence of dysphagia in institutionalized elderly and found that 31 percent were on a mechanically altered diet presumably due to dysphagia, with the most common underlying etiology being dementia in 42 percent, cerebral vascular accident (CVA) in 30 percent, deconditioning in 12 percent, and Parkinson's disease (PD) in 10 percent. Another study examined the occurrence of silent aspiration in asymptomatic "healthy" elderly individuals with community acquired pneumonia (CAP) versus a control group of age-matched persons using indium chloride scanning, and demonstrated a 71 percent incidence of silent aspiration in the CAP group, further highlighting the significant incidence of dysphagia in the aging population.

## Risk Factors and Dysphagia in the Elderly

Does normal aging result in dysphagia or is it always a pathologic state? Elderly individuals are more likely to experience dysphagia from diseases or conditions associ-

ated with the aging process than because of normal aging alone. The general consensus is that subtle changes in healthy elderly persons do not compromise the efficiency of safe oral intake in the absence of other co-morbidities. Thus it is important to differentiate between dysphagia in the elderly caused by risk factors and that due to “normal aging.”

Specific risk factors have been associated with the development of dysphagia in the elderly. The most common etiology of dysphagia in the elderly is CVA. The incidence of dysphagia after an acute CVA is estimated to be 40–70 percent. About 50 percent of elderly stroke patients aspirate in the immediate period after the insult, and about 25 percent die of aspiration pneumonia within the first year of rehabilitation. Studies looking at the localization of the CVA and the presence of dysphagia have shown that larger infarcts are associated with a higher likelihood of aspiration. Subcortical and periventricular white matter lesions are more associated with poor lingual coordination and dysphagia affecting the oral phase of swallowing. Infarcts in the brainstem area have a higher incidence of dysphagia and aspiration.

The presence of other neurological disorders associated with dysphagia also increase in incidence with aging. Parkinson’s disease is the most common neuromuscular disease in the elderly with frequent occurrence of dysphagia. Bird and colleagues noted a 15–20 percent incidence of aspiration on radiologic study in asymptomatic individuals with PD. Dysphagia in PD is typically multifactorial and related to rigidity/bradykinesia-causing delays. In addition, amyotrophic lateral sclerosis (ALS) is also more frequently seen in older individuals. ALS involves rapid and progres-

sive degeneration of upper and lower motor neurons. It is important to note that asymptomatic individuals with the spinal or nonbulbar form of ALS may still present with dysphagia because of compromised breath support. Dray and colleagues have noted that while laryngeal sensation is typically maintained in individuals with ALS, allowing for aspiration to be sensate, voluntary clearance from the airway may be affected by decreased pulmonary/abdominal support.

Polypharmacy is another risk problem in the elderly with a strong association between certain classifications of medications and the development of dysphagia. Anxiolytics like benzodiazepines are frequently prescribed in older individuals and known to metabolize more slowly, making them more suspect for the development of dysphagia because of their sedating effects and the consequent depression of the central nervous system (CNS). In another study, the researchers witnessed incidents of aspiration in the elderly and noted that the ingestion of sedative medications presumably impairing the cough reflex were the most important risk factor. Other medications frequently consumed by the elderly with similar effects on the CNS include antihistamines, phenothizine-based antiemetics, anticonvulsants, antipsychotics, opiates, and lithium, which impair cognition and awareness. Neuroleptic medications may predispose to extrapyramidal effects further leading to problems with swallowing. Additionally, anticholinergic medications, which have a drying effect on the oral mucosa, may also interfere with swallowing by impairing bolus transport and are known to be dose-dependent with increasing age.

The presence of bacteria in the oral cavity predisposes individuals with dysphagia and aspiration to more serious consequences like pneumonia. In the elderly, increased oropharyngeal colonization with pathogens like staphylococcus aureus and aerobic gram-negative bacilli is more prevalent. Additionally, edentulous elderly institutionalized individuals have a lower risk of aspiration pneumonia versus dentate elderly because of poor dental hygiene. A relation between oropharyngeal aspiration and low serum albumin has been found to increase the risk for the development of pneumonia, highlighting the importance of adequate nutrition in the elderly.

### Age-Related Changes and Dysphagia

Studies of changes in the swallowing mechanism caused by aging have demonstrated interesting findings. Changes in skeletal muscle strength are noted with age and may include reduced facial muscle strength resulting in poor cup drinking and decreased masticatory strength; decreased lingual pressure to drive the pharyngeal swallow; increased connective tissue within the body of the tongue restricting bolus control with repetitive tongue movements needed to clear the bolus; and frequent premature spillage of material over the base of the tongue.

Many of the physiologic changes that occur with aging are subtle, progressing slowly over time, which may allow the "healthy elderly" to adapt with compensatory mechanisms without incidents. It is also known that base-of-tongue propulsion is critical to bolus transit into the up-

per esophageal sphincter (UES). Robbins and colleagues have studied lingual pressures in the elderly and found that pressures do not decline with age but differences between maximum isometric and swallow pressures decrease, suggesting that as individuals age they accommodate by working harder to maintain critical pressures for safe and effective bolus passage.

A delay in triggering the pharyngeal swallow has also been reported with normal aging. A study of older versus young asymptomatic individuals found that the older group was more likely to have a delayed swallow response with multiple swallows needed to clear a bolus. They additionally found that older individuals had a three-fold increase in the action of inspiration versus exhalation after the swallow, increasing the likelihood of laryngeal penetration caused by residual material remaining in the hypopharynx after the first swallow.

Oral and pharyngeal transit times are another area of swallowing physiology that is subject to change with aging. Older individuals have been found to have prolonged oral bolus transit times, and increased pharyngeal bolus transit times, placing them at increased risk of aspiration. Other authors have found increased duration of the swallow with longer closure and opening of the airway and UES with increased age in asymptomatic women. In addition, Robbins' study showed that the speed of swallowing gradually slows after age 45 with a significant difference between individuals below 45 versus over 70 years of age.

Timely laryngeal motion, both superiorly and anteriorly, is critical to airway protection during swallowing. Studies have suggested changes in the strength and timing of laryngeal elevation with secondary effects on cricopharyngeal relaxation. Logemann and colleagues studied laryngeal movement in older individuals and found gender differences. Older men were found to have reduced hyoid motion while older women retained muscular reserve. Additionally, they found that cricopharyngeal relaxation was reduced in the males implicating a greater risk for dysphagia in normal older men because of their lower muscular reserve. However, the degree of reduced motion and its relation to dysphagia is not as clear. Reduced resting tone in the upper esophageal sphincter resulting in delayed UES relaxation is seen in older individuals, with decreased cross-sectional area in the esophageal inlet. An additional consequence of the change in UES function is the increased incidence of Zenker's diverticulum in the elderly.

A connection between breathing and, more specifically, increased apnea duration during the swallow has been found with aging and is felt to be a protective mechanism because it enables the system to compensate for other age-related changes including longer oropharyngeal and hypopharyngeal transit times and delayed initiation of maximum hyolaryngeal excursion. In contrast, another study found longer swallowing apnea duration in women versus men, which, in fact, decreases with age. Further evidence of changes in breathing and swallowing with advanced age is found in a study showing that SpO<sub>2</sub> levels were lower only in elderly individuals with dysphagia. Oxygenation during swallowing was not affected in healthy, asymptomatic older individuals.

The cough reflex is an important respiratory defense mechanism against aspirated material. Changes in the cough reflex with age have been reported by some authors, placing the elderly at greater risk for aspiration pneumonia. Other researchers have not been able to replicate this decline. Nakazawa and colleagues studied three groups of elderly individuals: healthy and asymptomatic, dementia but no suspected dysphagia, and history of aspiration pneumonia. The only group that had significant changes in the cough reflex was the one with a history of aspiration pneumonia, which demonstrated increased latencies in reaction to inhaled citric acid versus the other two groups. This was confirmed by another study that also found no significant change in the cough reflex in asymptomatic older individuals, and theorized that the results from the other studies may have been related to other risk factors prevalent in that population.

Weight loss is a frequent sign of dysphagia. However, eating history and weight stability are not always consistent. Some of the above-mentioned physiologic changes that occur with aging happen gradually, allowing the individual to adapt and compensate. This is frequently accomplished by taking nutritional supplements or more calorie-rich-type foods like shakes and puddings, thus disguising their underlying difficulty swallowing. Additionally, changes in the sense of taste and smell may affect the diet of the elderly. Flavor preferences have been shown to shift in older individuals as they perceive greater concentrations of sugar and salt as being pleasant, despite the fact that these substances are frequently restricted from



their diets. A loss of chemosensory perception altering the sense of smell is also found with age, and is related to degeneration of the olfactory nerve and mucosa that may interfere with older individuals having difficulty identifying blended foods. Thus, it appears that older individuals may benefit from stronger-flavored foods to compensate for their decreased perception, which in turn may have a positive effect on appetite and nutrition.

In summary, dysphagia is an increasing problem in the elderly. Although specific physiologic changes occur with the normal aging process, these are frequently well compensated for in the healthy older person. It is further critical to recognize the relationship between other co-morbidities and the normal physiologic changes, because these co-morbidities significantly increase the likelihood of developing dysphagia and its potential complication of aspiration pneumonia.

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