Pharyngeal Wall Differences in Young and Elderly Normal Subjects

Shervin Aminpour, MD, Rebecca Leonard PhD, Scott C. Fuller MS, MD, Peter C. Belafsky MD, PhD
University of California, Davis, Department of Otolaryngology-Head and Neck Surgery

Abstract

OBJECTIVES: The purpose of this investigation was to compare pharyngeal wall thickness at rest and when maximally constricted during swallow in young versus elderly persons.

METHODS: Videofluoroscopic swallow studies were performed on 190 normal adults. Measures of posterior pharyngeal wall thickness were determined at rest and during maximum constriction of the pharynx during a 20-cc bolus swallow.

RESULTS: Mean pharyngeal wall thickness at rest was .39cm (+/- .09) for the younger group and .30cm (+/- .08) for the elderly (p < 0.01). Pharyngeal wall thickness measured at the same point during maximum constriction was 1.08cm (+/-34) for the younger group and .92cm (+/- .36) for the elderly (p< 0.01).

CONCLUSIONS: Data from the current study suggest that the posterior pharyngeal wall is thinner and does not constrict to the same extent in elderly subjects as compared to younger individuals.

Introduction

The incidence of dysphagia rises sharply with advanced age. As the population ages, by 2010 an estimated 16.5 million persons will require treatment for swallowing difficulty (1). The incidence of aspiration pneumonia, an infectious disease frequently associated with disordered swallowing and with high morbidity, mortality, and cost, has reached epidemic proportions in the United States (2-4). These conditions lead to longer transit times, increased stasis of bolus particles, and increased residue that can predispose to aspiration (5,6). The purpose of this paper is to compare pharyngeal wall thickness (PWT) in young versus elderly persons and, if differences are identified, to consider how they may impact pharyngeal strength, swallowing efficiency, and safety in the elderly.

Methods and Materials

Subjects

178 adults with no history of dysphagia or swallowing complaints, no craniofacial anomalies, and no history of cerebrovascular accident or neuromuscular disease underwent videofluoroscopic swallow studies. The first group consisted of 53 females and 36 males under the age of 65 years, with a median age of 37 years. A second group, matched for gender with the first group consisted of 53 females and 36 males under the age of 65 years, with a median age of 70 years.

Fluoroscopic studies

Radiographic studies were conducted at the Voice and Swallowing Center at U.C. Davis in accordance with the routine radiographic protocols approved by the institution. Subjects adhered to a swallowing protocol that included 1cc, 3cc, and 15-20 liquid bolus swallows from a spoon or cup as well as cookie and paste swallows. A measure of the unconstricted pharyngeal wall was made from an oral cavity view of the 1cc liquid bolus held in the oral cavity prior to swallow. This pseudo-resting point is referred to as “PPWhold.” Pharyngeal wall thickness was also measured at the point of maximum pharyngeal constriction between cervical vertebrae 2 and 3 (PPWmax) (7,8). For each measure, a vertical line was first drawn along the most anterior aspect of the second and third cervical vertebral bodies (C2-C3). The horizontal thickness measurement was then made by extending a straight line from the anterior edge of the pharyngeal wall to the vertical line at the mid-point of C3. This point was chosen because pharyngeal constriction here is critical to bolus propulsion and to clearing of bolus material from the vallecular base and tongue during swallow. The measure was repeated at the point representing maximum constriction of the pharyngeal wall between C2 and C3 during the 20cc bolus swallow. The measures are illustrated in Figure 3.

Figure 1. PPWhold for normal subjects, including young males (YM), young females (YF), elderly males (EM) and elderly females (EF).

Figure 2. PPWmax for four groups of normal subjects, including young males (YM), young females (YF), elderly males (EM) and elderly females (EF).

Figure 3. Measurement of posterior pharyngeal wall thickness with a 1cc bolus held in the oral cavity (PPWhold) is illustrated on the left. On the right, maximum thickness of the wall during a 20cc bolus swallow (PPWmax) is measured. For both a vertical line is extended along the anterior surfaces of 2-3 cervical vertebrae. A horizontal line is then drawn from the visible anterior edge of the pharyngeal wall to the vertical line. For PPWmax, the measure is taken at the most prominent point of pharyngeal movement during swallow between mid-C2 and mid-C3.

Results

Data for the one-way ANOVA are presented in Table 1. Significant between and within-group differences were identified for both variables. Results for the four subgroups are illustrated in Figures 1 and 2. Though values for females are generally smaller than those for males, in both groups and for both PPWhold and PPWmax, post-hoc Bonferroni testing revealed these differences were not significant. As noted, the data were then pooled across gender for comparison by age.

Table 1. Results of ANOVA for PPWhold and PPWmax. Both PPWhold and PPWmax differed significantly according to age.

<table>
<thead>
<tr>
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<th>PPWhold</th>
<th>PPWmax</th>
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<tr>
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<tr>
<td>Both Groups</td>
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<tr>
<td>YM</td>
<td>1.273</td>
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<tr>
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Conclusions

Data from the current study suggest that the posterior pharyngeal wall is thinner and does not constrict to the same extent in elderly subjects as compared to younger individuals. These findings contribute to our understanding of differences in pharyngeal strength, swallowing efficiency, and safety associated with aging.

References