Pathophysiology, Relevance and Natural History of Oropharyngeal Dysphagia among Older People

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Abstract

Oropharyngeal dysphagia (OD) is a very frequent condition among older people with a prevalence ranging from mild symptoms in 25% of the independently living to severe symptoms in more than 50% living in nursing homes. There are several validated methods of screening, and clinical assessment and videofluoroscopy are the gold standard for the study of the mechanisms of OD in the elderly. Oropharyngeal residue is mainly caused by weak bolus propulsion forces due to tongue sarcopenia. The neural elements of swallow response are also impaired in older persons, with prolonged and delayed laryngeal vestibule closure and slow hyoid movement causing oropharyngeal aspirations. OD causes malnutrition, dehydration, impaired quality of life, lower respiratory tract infections, aspiration pneumonia, and poor prognosis including prolonged hospital stay and enhanced morbidity and mortality in several phenotypes of older patients ranging from independently living older people, hospitalized older patients and nursing home residents. Enhancing bolus viscosity of fluids greatly improves safety of swallow in all these patients. We believe OD should be recognized as a major geriatric syndrome, and we recommend a policy of systematic and universal screening and assessment of OD among older people to prevent its severe complications.
Prevalence

Prevalence of oropharyngeal dysphagia (OD) among the elderly is extremely high. Although sufferers are sometimes unaware of their oropharyngeal dysfunction, OD is a highly prevalent clinical condition which may affect up to 30–40% of the population 65 years old or more. More than 16 million US and up to 30 million European older people will require specific care for dysphagia by this year 2011, and we have proposed the recognition of OD as a geriatric syndrome [1]. Prevalence of OD is higher in older patients with neurodegenerative diseases (up to 80%), or stroke (40%) and is also related to age, frailty (44%) and some common comorbidities in older people, such as muscular, endocrine or psychiatric diseases [2]. We recently studied the real prevalence of OD among independently living older persons, and found the following prevalence: OD, 23.0% (16.6% in the 70–79 years group and 33.0% in the ≥80 years group), impaired efficacy of swallow, 16.8% (9.5% in the 70–79 years group and 28.3% in the ≥80 years group), impaired safety of swallow, 11.4% (6.8% in the 70–79 years group and 18.6% in the ≥80 years group), and oropharyngeal aspiration, 0.74% (0% in the 70–79 years group and 4.4% in the ≥80 years group) [3]. Prevalence of OD among elderly hospitalized patients is much higher, and age >75 years doubles the risk of dysphagia and has a significant impact on morbidity and hospital length of stay [4]. We also found dysphagia affected up to 44% of patients admitted to the acute geriatric unit of our hospital and had a significant impact on prognosis and mortality of patients [5]. Dysphagia also affects more than 50% of older people living in nursing homes, and up to 29% of them were tube fed mainly due to severe aspirations [6]. All these data indicate that OD is a prevalent and serious condition among the main phenotypes of older patients.

The current state of the art of OD management among the elderly aims at: (a) the early identification of patients at risk for dysphagia, (b) the assessment of its pathophysiology and the alterations in the swallow response, and (c) the prevention and treatment of the potential complications of dysphagia such as malnutrition, dehydration and aspiration pneumonia (AP).

Pathophysiology

Videofluoroscopy (VFS) is the gold standard for the study of the mechanisms of dysphagia in the elderly. Main observations during VFS are done in the lateral plane while swallowing 5- to 20-ml boluses of a hydroosoluble contrast of at least three consistencies: liquid, nectar and pudding [7–9]. The aim of the VFS study in these older patients is: (a) to evaluate the safety and efficacy of deglutition, (b) to characterize the alterations of deglutition in terms of videofluoroscopic signs, (c) to help select and assess the effect of treatments, and (d) to make accurate measurements of oropharyngeal swallow response [8, 9]. At our institution,
VFS is performed on every older patient with a positive screening for OD using the VVST [10]. VFS can assess several signs related to the transport function of swallowing, the efficacy of deglutition, which is the patient’s ability to ingest all the calories and water he or she needs to remain adequately nourished and hydrated, and (b) safety, which is the patient’s ability to ingest all needed calories and water with no respiratory complications [8–12].

The main VFS signs of efficacy of swallowing in the oral preparatory phase are impaired lip closure allowing bolus spillage in 20% of frail older patients and incapacity to form the bolus, which leads to the bolus spreading throughout the entire oral cavity also in 20% [8, 11]. Major signs of impaired efficacy during the oral stage include apraxia and decreased control and bolus propulsion by the tongue with piecemeal deglutition (multiple swallows per bolus). Many older patients present deglutitional apraxia (difficulty, delay or inability to initiate the oral stage) following a stroke [13]. This symptom is also seen in patients with Alzheimer’s, dementia and patients with diminished oral sensitivity. Impaired lingual propulsion in the elderly is caused by tongue sarcopenia [14] and leads to oral or vallecular residue in 40 and 60% of older patients with OD, respectively [11]. The main sign regarding safety during the oral stage is glossopalatal (tongue-soft palate) seal insufficiency, a serious dysfunction that results in the bolus falling into the hypopharynx before the triggering of the oropharyngeal swallow response and while the airway is still open, which causes predeglutitive aspiration [1, 8].

Pharyngeal residue is the main VFS sign of efficacy of the pharyngeal phase. Homogeneous residue in the pharynx is a symptom of weak tongue squeeze and reduced pharyngeal clearance, often observed in frail older patients with neuromuscular diseases. In contrast, unilateral residue is a symptom of unilateral pharyngeal dysfunction, and residue in one pyriform sinus shows a weak unilateral pharyngeal contraction; this is a very common sign in patients with stroke [9]. Postdeglutitive residue is an important VFS sign as aspiration after the pharyngeal swallow is the result of ineffective pharyngeal clearance. The VFS signs of reduced safety of the pharyngeal phase are penetrations and aspirations into the airway. A laryngeal penetration occurs when the bolus enters the laryngeal vestibule and aspiration when liquid traverses the true vocal folds and enters the airway. We observed penetration into the laryngeal vestibule during liquid series in up to 55% of frail older patients and tracheobronchial aspiration in up to 15% [11]. The severity of aspirations and penetrations can be further characterized according to Rosenbek’s penetration-aspiration scale and according to whether they are followed by cough or not (silent aspirations) [15]. Mechanisms of aspiration are classified as predeglutitive (before activation of pharyngeal phase), intra- and postdeglutitive [16, 17]. Through VFS, we found serious swallowing and cough reflex disorders in a group of frail elderly patients as more than half presented penetrations of ingested material into the laryngeal vestibule or aspirations beyond the vocal folds during the
swallow response, many of which were silent due to simultaneous impairment of cough reflex [11].

From a biomechanical perspective, the two main components of oropharyngeal swallow response are the configuration of the oropharynx from a respiratory to a digestive pathway, and the transfer of the bolus from the mouth to the esophagus which includes bolus propulsion, the opening of the upper esophageal sphincter, and pharyngeal clearance [1]. Quantitative measurements of each one of these components can be easily obtained in the clinical setting with VFS [1, 8, 9, 11, 16]. The normal swallow response is characterized by short duration – less than 1 s –, very fast configuration of the oropharynx from a respiratory to a digestive pathway with early protection of airway and fast laryngeal vestibule closure (LVC) – less than 160 ms –, and strong bolus propulsion by tongue squeeze with high bolus velocity [11]. In contrast, OD in the elderly is mainly characterized by high prevalence of penetrations and aspirations during swallow response, and oropharyngeal residue [11]. Pathophysiology of impaired safety and aspirations is mainly associated with delayed LVC and delayed maximal anterior and vertical hyoid movement (fig. 1), and impaired efficacy is associated with weak tongue squeeze and weak bolus propulsion forces [11]. Future specific treatments for OD in the elderly should be targeted to improve these critical physiological events.

Impaired swallow response in the frail elderly is caused by neurogenic and myogenic factors (table 1). Studies on healthy people over 80 years of age found that normal aging delayed and prolonged swallow response and increased oropharyngeal residue [18–20]. Delayed swallow response has been attributed to impaired function of peripheral afferents to the swallowing center and slow
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Synaptic conduction in the central nervous system caused by high prevalence of neurological and neurodegenerative diseases in the elderly as well as the neurodegenerative process related to ageing [21]. Drugs with detrimental effects on consciousness or swallow response can also contribute to delayed swallow response [22]. Weak muscular tongue strength caused by sarcopenia is the major contributor to impaired bolus propulsion [14]. Table 1 summarizes the main elements causing OD in the elderly [1].

**Natural History, Prognosis and Complications**

OD causes severe and specific complications in several phenotypes of older patients that can lead to death. The impact of OD on the health of older patients is higher than that of other chronic conditions such as metabolic and cardiovascular diseases and even that of some types of cancer [23]. OD may give rise to two groups of clinically relevant complications in older people: (a) malnutrition and/or dehydration caused by a decrease in the efficacy of deglutition, and (b) choking and tracheobronchial aspiration caused by the decrease in deglutition safety and which results in respiratory infections and AP with high mortality rates [1]. Despite this, OD is underestimated and underdiagnosed as a cause of symptoms and major nutritional and respiratory complication in older patients. Figure 2 summarizes the pathophysiology of complications related to dysphagia.
in the elderly [1]. Several studies have evaluated the impact of OD and these specific complications among different phenotypes of elderly people. First, in a transversal study on a cohort of independently living older persons, we found high prevalence of OD was statistically associated with advanced age, low Barthel score, benzodiazepines treatment, depression, slow walking speed, and low overall quality of life (QoL) [3]. Moreover, a close relationship between signs of OD and poor functional capacity was observed and, independent of age and functional capacity, impaired efficacy of swallow was associated with an increased risk of malnutrition [3]. We also performed a longitudinal study with similar patients, and found that prevalence of malnutrition at one-year follow-up was associated with basal OD and with basal signs of impaired efficacy of swallow [24]. Likewise, annual incidence of low respiratory tract infections (LRTIs) was higher in subjects with basal signs of impaired safety of swallow in comparison to subjects without such signs, clearly showing OD is a risk factor for malnutrition and LRTIs in independently living older persons [24]. The social and psychological impact of OD on older patients living in nursing homes in Europe was measured in a study that found a major negative impact of OD on QoL of these patients in that only 45% patients found eating pleasant, 41% felt anxiety or panic during mealtimes, and 36% avoided eating with others because of OD [2].

Fig. 2. Nutritional and respiratory complications associated with OD in older patients.
We also studied the prevalence and clinical impact of OD as a potential geriatric syndrome in 1,160 patients (mean age 84 years) admitted to the geriatric unit of our hospital due to several acute diseases, and found that 44% of older patients presented OD and that the prevalence of malnutrition (33%), weakness, length of stay, impaired functional capacity, morbidity and one-year mortality (40% in patients with OD) was significantly increased in older patients with OD [25]. More recently, in a study using clinical tools, biochemical markers, anthropometric measurements and bioimpedance, we found that 66% of older patients with VFS signs of OD were malnourished or at risk of malnutrition and presented severe depletion of muscular protein and intracellular water showing subclinical dehydration, another very frequent complication in older patients with OD [26].

The impact of OD on prognosis and mortality is especially severe in older patients with AP as one of the consequences. A recent 10-year review found a 93.5% increase in the number of hospitalized older patients diagnosed with AP, while other types of pneumonia in the elderly decreased [27]. AP occurs in the first days following stroke in up to 20% of patients, and is the first cause of one-year mortality after discharge [13, 28]. We studied 134 older patients (>70 years) with pneumonia consecutively admitted to an acute geriatric unit in our general hospital. Of the 134 patients, 53% were >84 years old, and 55% presented clinical signs of OD; the mean Barthel score was 61 points, indicating a frail population. Patients with dysphagia were older, showed lower functional status, higher prevalence of malnutrition and comorbidities, higher Fine's pneumonia severity scores and higher mortality at 30 days (22.9 vs. 8.3%, p = 0.033) and at 1 year of follow-up (55.4 vs. 26.7%, p = 0.001) [22]. OD can thus be considered a highly prevalent clinical finding and an indicator of disease severity in older patients with pneumonia [22]. Also recently, we found VFS signs of impaired safety in up to 54% of older patients admitted to our hospital with community-acquired pneumonia and a marked delay in LVC. In elderly nursing home residents with OD, AP occurs in 43–50% during the first year, with a mortality of up to 45% [28].

Taken together, these results confirm that OD is a major factor for malnutrition, pneumonia, impaired QoL, and other complications including mortality in very different phenotypes of older patients ranging from independently living older subjects to hospitalized patients and older patients living in nursing homes. However, dysphagia with oropharyngeal aspiration is rarely considered a risk factor in elderly patients with community-acquired pneumonia or in elderly patients with malnutrition. We therefore recommend a policy of universal screening for and assessment of OD as part of the standard geriatric evaluation of these patients. We also believe OD fulfills most criteria to be recognized as a major geriatric syndrome as its prevalence is very high in geriatric patients and leads to multiple diseases, risk factors and precipitating diseases, and represents a specific target for therapeutic interventions [29].

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Identification of videofluoroscopic signs allows the classification of patients with dysphagia into several therapeutic categories ranging from: (a) patients with safe and efficient swallowing that can achieve free oral intake; (b) patients with mild symptoms that need strategies based on the reduction of volume and increase in bolus consistency; (c) patients with severe symptoms that also need changes in head posture, heightened sensory input, and swallow maneuvers, and (d) those patients with such severe aspirations or such inefficient swallowing that they need percutaneous endoscopic gastrostomy in order to avoid respiratory complications or malnutrition [1, 8]. We try to maintain a minimal safe oral intake in these latter patients, with eventual rehabilitation as our aim. The specific indication for each one of these treatments has been summarized recently in a clinical guideline [8]. The strategies for rehabilitation and the effect of therapy by SLP will be discussed in two specific chapters of this volume, and have been recently revised [30]. In the first stage of our research strategy, we assess the therapeutic effect on OD and swallow physiology of the two main therapeutic approaches: (a) changes in bolus volume and viscosity and dietary adjustments [8–11], and (b) new neurophysiologic stimulation treatments based on electrical or pharmacological therapies [1, 31].

We have performed several studies to assess the therapeutic effect of increasing bolus viscosity with thickeners in patients with functional OD. We first calculated the amount of thickener (Resource Thicken Up; Nestlé Healthcare Nutrition, Spain) to be added to the X-ray contrast in order to have appropriate viscosities for the VFS studies: 20.4 mPa•s for liquids, 274.4 mPa•s for nectar, and 3,931.2 mPa•s for pudding [9–11]. We then studied the effect of thickeners on patients with OD caused by non-progressive brain damage (mainly stroke), neuromuscular degenerative diseases including amyotrophic lateral sclerosis, multiple sclerosis or myopathies [9], older patients with neurological, neurodegenerative or head and neck diseases [10], and frail elderly patients [11]. In all these phenotypes of older patients, we found scientific evidence of a strong therapeutic effect on efficacy and safety of oral and pharyngeal phases of swallowing by enhancing bolus viscosity to nectar and a maximal therapeutic effect on safety at pudding viscosity [9–11]. Thickeners minimized the prevalence of VFS signs of impaired safety in frail elderly patients and reduced aspirations from 17% during liquid series to 9% at nectar viscosity and 6% with pudding [11]. In contrast, increasing bolus volume severely impaired safety and efficacy of deglutition, and pudding viscosity increased oropharyngeal residue [11]. Increasing bolus viscosity in these patients did not correct prolonged duration of mechanical components of the oropharyngeal swallow response, and the mechanism of its therapeutic effect seems to be related to an effect of intrinsic bolus characteristics and not to an improvement in the swallow response [9–11]. Taken together, these results show that fluid adaptation should be adopted
as a first-line treatment in all older patients with OD, and similar studies should be conducted to demonstrate the potential therapeutic effect of the adaptation of the consistency of solid foods on safety and efficacy of deglutition [1].

In addition, we believe that specific treatments for impaired swallow response in older persons should be developed and assessed. The pathophysiological factors causing dysphagia in the frail elderly can be treated potentially by: (a) the stimulation of TRPV1 receptors located in afferent sensory fibers from the larynx (superior laryngeal nerve) or the pharynx (pharyngeal branch of the glossopharyngeal nerve) by acid, thermal stimulation or specific TRPV1 agonists to speed the neural swallow responses [31]; (b) rehabilitation by lingual resistance exercises, an effective treatment for patients with lingual weakness and dysphagia due to frailty [14], and (c) the classical suprahypoid exercise program (Shaker maneuver) to improve hyoid motion and UES opening [32]. Electrical stimulation of suprahypoid muscles has also improved hyoid and laryngeal elevation [33].

Treatment of dysphagia in older patients varies greatly between centers. This variability can contribute to controversy over the effect of swallowing therapy in preventing malnutrition and AP in older persons. In addition, there are a limited number of studies addressing these – unresolved – questions. We believe that OD in the elderly can be treated, and treatment is cost-effective, and that the use of dysphagia programs is correlated with reduction in the impact of its complications, improvement in nutritional status, reduction in AP rates and mortality, and overall improvement in QoL.

References