

## Oropharyngeal Dysphagia: Aetiology and Effects of Ageing

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Received: January 31, 2014 Revised: March 2, 2014

Accepted: March 8, 2014

Published online: May 21, 2014

in older people, from prevalence to a general intervention strategy for correct diagnosis and treatment.

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**Key words:** Deglutition disorders; Dysphagia; Older people; Frailty; Aspiration; Aspiration pneumonia

Ortega O, Cabré M, Clavé P. Oropharyngeal Dysphagia: Aetiology & Effects of Ageing. *Journal of Gastroenterology and Hepatology Research* 2014; 3(5): 1049-1054 Available from: URL: <http://www.ghrnet.org/index.php/joghr/article/view/693>

### ABSTRACT

Oropharyngeal dysphagia (OD) is a very prevalent swallowing disorder among older people that causes severe complications such as malnutrition and dehydration (due to impaired efficacy of swallow) and respiratory infections and pneumonia (caused by impaired safety of swallow) with detrimental outcomes such as high hospital readmission rates and mortality. In addition, these complications and poor outcomes have great economic and social impact. Older patients with OD should be diagnosed and treated early to prevent or minimize complications and economic and social costs. Management of patients with OD is of key importance and several screening and diagnostic tools and methods (EAT-10, volume-viscosity swallowing test, FEES and videofluoroscopy) are available. In addition, different types of treatments have been described and are being used and new ones are being studied and developed. There is a strong case for OD to be considered a geriatric syndrome because it is highly prevalent, has serious repercussion on the overall health status of the patient, is related to multiple risk factors, follows diverse aetiopathogenic pathways is a part of the aetiopathogenic cycle of frailty and is able to induce it. For these reasons, OD should be systematically integrated into the management of older patients. This chapter gives an overview of OD

### INTRODUCTION

Swallowing efficiently is critically important for human beings as it is the mechanism that makes liquids and nutrients pass from the oral cavity to the stomach enabling proper nourishment and hydration. In addition, eating (deglutition) is a social and cultural activity that has a role in the society and can give us a sense of satisfaction. Any disturbance in this process has both a clinical and quality-of-life impact on its sufferers. Swallowing disorders can affect several risk groups of patients: patients with neurological or neurodegenerative diseases, stroke patients, patients with head and neck diseases and the older population. Actually, the proportion of older people all over the world is rapidly increasing (more than 17% of European citizens are >65 years). In the last decade, this group has increased by 28% and rest of the population has only grown by 0.8%<sup>[1]</sup> meaning that, in the near future, swallowing disorders will become an important concern for the world medical and health care community.

Oropharyngeal dysphagia is a common but little-known symptom among older people and it is defined as a motility disorder which leads to difficulty or inability to swallow safely (WHO ICD-9, 787.20; ICD-10 R-13). Although general medical knowledge of this condition is gradually growing, OD is underdiagnosed in most medical centres and nursing homes treating older patients<sup>[1]</sup>. However, OD causes severe nutritional and respiratory complications with detrimental outcomes and mortality. In addition many patients suffering it are not aware of their condition. The severity of OD lies in the serious complications that it is related to: alterations in the efficacy of swallowing with dehydration and malnutrition (MN);

and alterations in swallowing safety leading to tracheobronchial aspirations and the development of respiratory infections and aspiration pneumonia (AP). Oropharyngeal dysphagia meets the criteria to be considered a geriatric syndrome as it is very prevalent in older patients, is related to multiple risk factors and causes various precipitating diseases<sup>[2]</sup>.

OD is a common manifestation in the different phenotypes of older patients (from robust to frail patients) and of special interest in the frail older population. The principal characteristics of this population are: multiple comorbidities, low functional capacity, sarcopenia, MN, impaired immunity, dry mouth (xerostomia), polymedication and poor oral health and hygiene habits<sup>[3,4]</sup>. OD increases care needs, costs and social impact and is associated with several adverse events: disability, comorbidities, functional impairment, MN and geriatric syndromes. In addition, OD has a detrimental effect on quality-of-life, affective status, social integration and cultural-alimentary patterns.

## PREVALENCE

Prevalence of OD is difficult to determine because it varies with the area of medical attention, disease status of the patient and the country where the research was carried out<sup>[1]</sup>. However, OD is very prevalent among older people and this prevalence is generally attributed to two main factors: (a) the ageing process, which causes deterioration in oropharyngeal physiology with alterations in the oropharyngeal motor response (OMR); and (b) the high prevalence of neurological and neurodegenerative diseases which increases with age<sup>[5]</sup>. OD affects up to 23% of community-living older persons above 70 years old (16.6% in people from 70 to 79 and 33% in people above 80), 15% in people above 65, between 56% and 78% of institutionalized older patients and 47.5% of older patients hospitalized in an acute geriatric unit<sup>[1,6]</sup>. In addition, it affects up to 30% of patients suffering from stroke, between 52% and 82% of patients with Parkinson's disease, up to 60% of patients with lateral amyotrophic sclerosis and 40% with multiple sclerosis, and 84% of patients with Alzheimer<sup>[1,7,8]</sup>. In addition, it is related with some common comorbidities in older people such as muscular, endocrine and psychiatric conditions. The prevalence is so high that 16.5 million US senior citizens and more than 40 million Europeans require specific care for OD<sup>[9]</sup>. The healthcare costs associated with OD in the USA have been estimated at around 547 million US dollars/year<sup>[10]</sup>. The mean cost of an episode of AP is 17.000 US\$ and increases with the comorbidities of the patient<sup>[11]</sup>. Although medical expenses can be objectively determined, quality-of-life, social integration and psychological health are more difficult to evaluate.

## PATHOPHYSIOLOGY

OD in older people has several aetiological causes, ranging from structural alterations that hinder the progression of the bolus to changes in pharyngeal motility. Common structural abnormalities include oesophageal and ENT tumours, oesophageal stenosis, Zenker's diverticulum and neck osteophytes. More frequent, however, are disorders of the OMR which can be caused by the ageing process, sarcopenia, stroke, drugs with effects on swallowing physiology and systemic, neurological, neurodegenerative and muscular diseases. Risk factors attributed to OD in older people are age, low functional capacity (low Barthel index score -with the greatest associated risk-), neurodegenerative diseases, treatment with drugs affecting the central nervous system, MN and depression<sup>[12]</sup>.

The deglutition process is divided into four main phases: the

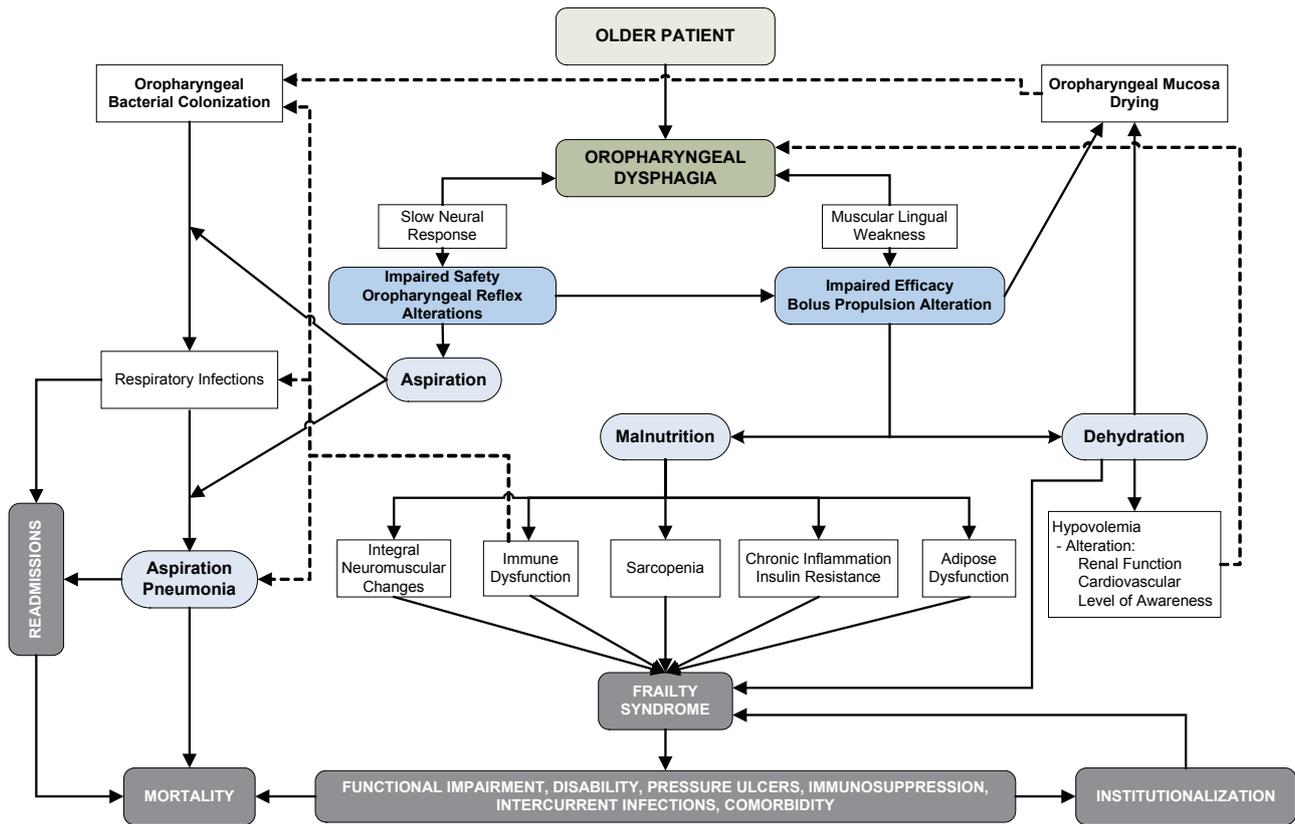
oral preparatory phase, the oral phase, the pharyngeal phase and the oesophageal phase. Each one is characterized by different, sequentially occurring events that, in the older, are normally delayed by the process of ageing (presbyphagia) or impaired (dysphagia)<sup>[13]</sup>. (a) The oral preparatory phase is voluntary and its objective is mastication and formation of the bolus; (b) the beginning of oral phase is voluntary and is characterized by the bolus propulsion mediated by the action of the tongue; this phase is connected with (c) the pharyngeal phase that is involuntary and is initiated by the stimulation of pharyngeal receptors that mediate the beginning of the OMR, characterized by the following sequence: closure of the nasopharynx and respiratory airways, opening of the upper oesophageal sphincter (UOS) and contraction of the pharyngeal constrictor muscles<sup>[1,8,14]</sup>; (d) the oesophageal phase is involuntary and is initiated by the aperture of the UOS followed by oesophageal peristalsis<sup>[15]</sup>. In young healthy adults (40 years), the total duration of the swallowing reflex is very fast (<740 ms) and the initial phase of the aerodigestive reconfiguration is under 160 ms<sup>[16]</sup>. In older persons, however, the reflex is delayed (>800 ms) and the aerodigestive reconfiguration even more (>623 ms). In addition, the propulsion force of the tongue changes bolus velocity (31 cm/s young *vs* <20 cm/s old) and kinetic energy (<0.33 mJ young *vs* <0.15 mJ old)<sup>[4]</sup>.

Pathogenesis of OD can be divided between those caused by impaired safety or impaired efficacy of swallow. The pathogenesis of impaired safety of swallow is related to neural alterations that slow down the physiological responses of the pharyngeal reconfiguration (especially of the laryngeal vestibule). These slow, deglutitive, neural responses are associated with neurodegenerative diseases, frailty, confusion, aging, dementia and drugs with action to the central nervous system<sup>[15]</sup>. The pathogenesis of impaired efficacy of swallow is more closely related to muscular factors associated with weakness and sarcopenia that cause a decrease in the propulsion force of the bolus and/or altered pharyngeal clearance<sup>[9]</sup>.

## COMPLICATIONS

OD causes two main kinds of OMR alteration: (1) impaired efficacy and (2) impaired safety of swallow (Figure 1): (1) Complications due to impaired efficacy of swallow are mainly caused by poor bolus transport and the presence of residue after deglutition (oral or pharyngeal residue). This hinders the ingestion of the appropriate amount of nutrients and liquids that the organism needs to be hydrated and well-nourished and patients develop MN and dehydration. MN is highly prevalent among older patients and can induce frailty and sarcopenia. In one study on older patients with OD, prevalence of MN (MNA <17) was 33.3% and correlated with lower functional capacity (Barthel) and high mortality (40.4%) one year after discharge<sup>[12]</sup>. In another study on 89 older patients with OD ( $\geq 70$  years) performed at our hospital, the prevalence of MN was 61.5%<sup>[17]</sup>. The relationship between OD and MN has been recognized in a recent European Council resolution that recommends improving diagnosis and treatment of MN in patients with OD<sup>[18]</sup>; (2) Other complications are due to impaired safety, when swallowing produces penetrations into the laryngeal vestibule and tracheobronchial aspirations, sometimes without cough reflex (silent aspirations). This alteration causes lower respiratory tract infections (LRTI) and AP. Tracheobronchial aspirations among older people causes pneumonia in up to 50% of cases with an associated mortality of 50%<sup>[8]</sup>.

AP is contracted when food, liquid and/or oropharyngeal secretions, with any existing microorganisms, are aspirated into the respiratory tract and develop a bacterial infection. The Japanese



**Figure 1** Pathophysiology of nutritional and respiratory complications associated with oropharyngeal dysphagia in older patients.

Study Group on Aspiration Pulmonary Disease has defined AP as pneumonia occurring in patients with swallowing disorders and reported that the percentage of admissions due to AP among all admissions due to pneumonia increases gradually with age, from 0% in patients 50 years or younger to as high as 90% in those over 90 years of age<sup>[19]</sup>. This disease, which is frequent and recurrent in frail older patients, is closely related to the type and amount of microbial flora present in the oral and pharyngeal cavity<sup>[20,21]</sup>. Several risk factors related to oral health such as the presence of caries, number of functional dental pieces, periodontal disease and dental plaque have been associated with the appearance, severity and mortality of AP in older patients<sup>[21,22]</sup>. Several interventional studies have shown that improving oral hygiene (toothbrushing, antiseptic mouthwashes and antibiotics) reduces the incidence of pneumonia by 40%<sup>[23]</sup>. Another recent study on oral colonization showed that a program including early screening and intensified oral hygiene reduced the incidence of pneumonia compared with a control group without intervention (7% vs 28%;  $P<0.01$ )<sup>[24]</sup>. Oral colonization mechanisms that could facilitate the development of respiratory infection are: impaired host immunity, changes in commensal microflora and oral biofilm maturation<sup>[21]</sup>.

There are three main risk factors that predispose older patients to contract AP: (a) OD with impaired safety of swallow and aspirations; (b) frailty and impaired nutritional status; and (c) oropharyngeal colonization by respiratory pathogens. Each one of these stages is easily detectable and treatable among the older population but they are surprisingly neglected.

In USA, between 1992 and 1998, hospital admissions of older patients with AP increased by 93.5% while other causes of pneumonia remained stable<sup>[9,25]</sup>. In Europe, one study performed at Mataró Hospital with older hospitalized patients ( $\geq 80$  years) presenting community-acquired pneumonia (CAP) found that 55%

of them presented signs of OD and that these patients were older, had lower functional status, high prevalence of MN, higher comorbidities and higher severity of pneumonia (Fine index). Moreover, they presented higher 30-day (22.9% vs 8.3%,  $P=0.033$ ) and one year mortality (55.4% vs 26.7%,  $P=0.001$ )<sup>[12]</sup>. In another similar study with older patients ( $\geq 70$  years) with CAP, it was found that 53% had impaired safety of deglutition and a 1-year mortality rate of 40% (OD and CAP) vs 7% (no OD and CAP) ( $P=0.0157$ )<sup>[25]</sup>. These results indicate that OD is very prevalent in older patients with CAP and is an indicator of disease severity and poor prognosis in this population group. In another study with older patients from the community ( $\geq 70$  years), prevalence of OD was 23% and incidence of LRTI at 1-year follow-up was 40% (OD) vs 21% (no OD);  $P=0.030$ , indicating OD is very prevalent in older patients from the community and that it is associated with LRTI in this group of patients<sup>[27]</sup>.

OD and safety complications also have great economic impact due to the high hospital readmission rates of older patients with OD. In a recently published study with patients over 70 years admitted to an acute geriatric unit, prevalence of OD was 47.5%. These patients were followed up for an average of 24 months and it was observed that patients with OD had significantly more readmissions for pneumonia (6.7 readmissions/100 patients/year with OD vs 3.6 in patients without OD), AP (2.3/100 patients/year OD vs 0.45 no OD) and tracheobronchial aspirations (4.8/100 patients/year OD vs 1.1 no OD). Moreover, the readmission risk related to OD was 4.75 readmissions/100 persons-years<sup>[6]</sup>.

## DIAGNOSIS

Early diagnosis of OD in older patients is a key factor in avoiding possible complications. First, we have to examine the medical history of the patients to detect specific symptoms of OD: efficacy (piecemeal

deglutition, oral or pharyngeal residue, mealtime prolongation and weight loss), and safety (wet voice, cough or choking during meals or continuous readmissions for respiratory infections). A complete evaluation of older patients with OD should include: functional status, nutritional status and oral health and hygiene. Functional and nutritional evaluations are important to determine the general health status of the patients because two of the main complications of OD are MN and dehydration (which lead to sarcopenia, frailty and impaired immune system). Evaluation of oral health and hygiene is important to ensure low levels of bacteria in the oral and pharyngeal cavity and check for dental plaque.

OD diagnosis is based on the evaluation of swallowing characteristics (efficacy and safety). There are several diagnostic tools to assess OD. Screening tools like the EAT-10<sup>[28]</sup> and medical history of the patient are useful to make a first exploration to screen patients at risk of OD. Then, if the patient is suspected of having swallowing alterations, a clinical tool can be used to further assess swallowing disorders. Clinical assessment tools like the volume-viscosity swallowing test (V-VST)<sup>[14]</sup> are designed to be easy, quick and safe; in addition, these explorations can be done at the bedside of the patient and will determine the kind of alteration/s (efficacy and/or safety) that the patient has. These tools are also useful to indicate the most appropriate volume and texture for the patient to swallow to avoid complications. If more accurate swallowing assessment is needed, instrumental tools can be used like VFS (the gold standard) and fiberoptic endoscopic evaluation of swallowing (FEES). VFS is a dynamic radiological technique used to explore the OMR. The boluses (different volumes and textures) are stained with a contrast medium that can be followed during swallowing. Once deglutition is recorded, a detailed analysis of the OMR can be done with precise measurements (spatial and temporal quantitative measures) using specific software to determine all efficacy and safety alterations<sup>[7,8]</sup>. FEES uses a flexible fiberoptic with a light and a video recorder to register the deglutition process, although there is a whiteout which obscures the moment of swallow. To determine swallowing alterations, different food textures and alimentary dyes are used<sup>[29]</sup>.

## OD AS A GERIATRIC SYNDROME

Geriatric syndromes are multifactorial health conditions that occur when the accumulated effects of impairments in multiple systems make an older person vulnerable and induce frailty<sup>[30]</sup>.

We propose that OD be considered a geriatric syndrome because it is highly prevalent, has a negative impact on the global health status of the patient, is related with multiple risk factors, follows diverse aetiopathogenic pathways, is part of the aetiopathogenic cycle of frailty and is able to induce it. So, we suggest that it be integrated into the care and management of older patients in a systematic way (Figure 2).

## TREATMENT

Treatment of OD is currently based on postural strategies and manoeuvres to compensate biomechanical alterations of swallowing and on the adaptation of fluids and food to avoid or reduce incidence of penetrations and aspirations and subsequent future complications. Depending on the results of the assessment and diagnosis, patients should be given recommendations on adequate bolus volume and bolus texture (thickness) to prevent aspirations. Several studies have reported that modifications of bolus texture using thickeners improve efficacy and safety of swallow in patients with functional OD<sup>[4,14,31]</sup>. In addition, it is important to treat secondary complications

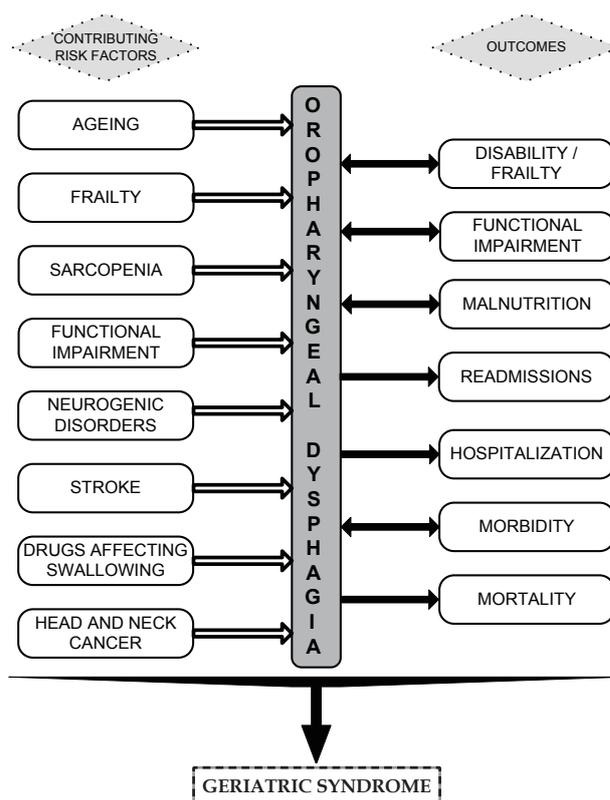


Figure 2 Oropharyngeal dysphagia as a geriatric syndrome.

such as MN, giving nutritional supplements (protein or energetic) as needed; and also to treat poor oral hygiene to reduce bacterial colonization. In one study performed on older patients ( $\geq 70$  years) with OD, oral health and hygiene was assessed. Results indicated that 69% of these patients had very poor oral hygiene, measured with a simplified oral hygiene index, and that prevalence of periodontal diseases and caries was 93% and 53% respectively<sup>[32]</sup>. Another study on the prevalence of respiratory pathogens in the oral and pharyngeal cavity of older patients ( $\geq 70$  years) with OD showed that 62% of these patients presented respiratory pathogens in the oral cavity and that colonization was higher compared with a group of older patients without OD ( $P < 0.05$ )<sup>[33]</sup>. The World Health Organization recently recommended that all countries should adopt strategies to improve oral health among older people and the European Council recommended improving diagnosis of OD and MN<sup>[18,34]</sup>.

In our hospital, we have developed a systematic screening program for all older persons ( $\geq 70$  years) admitted to the hospital. It is called Minimal-Massive Intervention (minimal measures to the maximal number of patients) and consists of early screening of patients for OD using the V-VST; if this test is positive, then patients are screened for MN (MNA-sf and bioimpedance) and for oral hygiene (OHI-S) and health status<sup>[35,36]</sup>. In addition, data regarding functionality, comorbidities and frailty are collected. This evaluation is also performed on discharge and if the patient still presents signs of OD, several recommendations based on the previous explorations are given to the patient to avoid complications. Then the patient is followed up at 3, 6, 9 and 12 months for OD, MN and oral health and hygiene and data regarding readmissions, respiratory infections, pneumonia and mortality are collected.

Moreover, in our hospital, new treatments for OD are being studied and developed. These new treatments, unlike the compensatory ones, try to improve swallowing physiology and are based on afferent and motor strategies. Some examples are TRPV1 receptor agonists and

transcutaneous and intrapharyngeal electrical stimulation. Further studies are needed to implement these new treatments in current medical practice<sup>[37-39]</sup>.

## DISCUSSION

The relevance and repercussions of OD have been shown to be of great importance among the geriatric population. The prevalence, complications, social and cultural implications and economical costs of OD have great impact on the national healthcare system and the society. Despite this impact, it is not screened and treated in many hospitals and nursing homes. We propose that OD be considered a geriatric syndrome as it is related to multifactorial health conditions and risk factors that result in complications that lead to MN, frailty, and vulnerability. OD has a poor prognosis and is a severity indicator for its sufferers. We propose that OD should be screened and treated in all geriatric patients in hospitals and nursing homes. Furthermore, OD diagnosis should be recorded using the WHO ICD codes (ICD-9, 787.20; ICD-10, R-13) in medical reports. Diagnosis and treatment of OD is easy, reliable, economical and effective and will improve patient outcomes and quality of life.

## CONFLICT OF INTERESTS

There are no conflicts of interest with regard to the present study.

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