

## Review Article

# The management of subacute-onset dysphagia in patients suffering from neurodegenerative disorders

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**ABSTRACT:** *Swallowing disorders affect large parts of the elderly population leading to ever-increasing mortality and morbidity rates, as a consequence of complications such as malnutrition and aspiration pneumonia. The impact of dysphagia on quality of life is even worse, when considering to what extent this condition may adversely affect the emotions generated by eating as well as impinge on the social aspects of meal preparation and intake. Dysphagia prevalence appears to be soaring especially in subjects suffering from neurodegenerative disorders, such as Parkinson's disease (PD) and amyotrophic lateral sclerosis (ALS). This paper will describe the current knowledge concerning swallowing impairment in PD and ALS, by focusing on epidemiological data, prognostic impact, pathogenesis, and treatment. It will also highlight the many problems currently preventing the accomplishment of a standard management of swallowing disorders in neurodegenerative diseases and discuss the novelties emerging from scientific research. (Nutritional Therapy & Metabolism 2007; 25: 167-72)*

**KEY WORDS:** *Amyotrophic lateral sclerosis, Dysphagia, Enteral nutrition, Parkinson's disease, Percutaneous endoscopic gastrostomy, Swallowing assessment*

## INTRODUCTION

Swallowing disorders affect large parts of the elderly population leading to ever-increasing mortality and morbidity rates, as a consequence of complications such as malnutrition and aspiration pneumonia (1). The impact of dysphagia on quality of life is even worse, when considering to what extent this condition may adversely affect the emotions generated by eating as well as impinge on the social aspects of meal preparation and intake.

Dysphagia prevalence appears to be soaring especially in subjects suffering from neurodegenerative disorders, such as Parkinson's disease (PD) and amyotrophic lateral sclerosis (ALS), with reported incidence of swallowing dysfunction in PD ranging from 30% to 52% (2, 3), and reaching 100% in ALS subjects in the advanced phase (4).

Recommendations concerning the usefulness of an early management of swallowing disorders have been recently added to guidelines on the best care provision for ALS (5) as well as PD patients (6, 7); however, many critical issues still remain to be unravelled before an

agreed care pathway may be designed and applied in clinical practice.

This paper will describe the current knowledge concerning swallow impairment in PD and ALS, by focusing on epidemiological data, prognostic impact, pathogenesis, and treatment. It will also highlight the many problems currently preventing the accomplishment of a standard management of swallowing disorders in neurodegenerative diseases and discuss the novelties emerging from scientific research.

## SWALLOWING DISORDERS IN PD

As already stated, the prevalence of dysphagia in PD subjects is all but clearly defined, ranging from 50% to 82% cases in retrospective studies (8, 9). An ongoing prospective investigation aimed at describing the incidence of non-motor disorders in parkinsonian syndromes (PRIAMO Study) has so far indicated gastrointestinal disorder rates (including dysphagia) of close to 77%, depending on disease duration and progression (10). The

vagueness of the reports and their noticeable inconsistencies raise relevant observations concerning both the true variability in dysphagia rate across PD samples and the reliability of dysphagia ascertainment.

The insidious onset of swallowing disorders and frequent underestimation by both PD patients and carers probably account for the poor reliability of the history data. On the other hand, studies checking for swallowing abnormalities by means of either clinical or instrumental assessments have to face the uncertain prognostic relevance of function impairment with respect to morbidity and mortality risk (11).

Overall, there is a diffuse awareness that the occurrence of perceived swallowing difficulties by PD patients leads to a predictable clinical and functional deterioration. In post mortem-confirmed parkinsonian syndromes, Muller et al (12) tried to quantify survival time after dysphagia onset and discovered that it ranged from 15 to 24 months, being very similar across different diagnostic groups, independent of symptom onset with respect to the whole disease duration. Therefore, no matter what the diagnosis or disease severity or length, the development of swallowing impairment gives way to harmful consequences in any stage of illness.

That dysphagia is probably one of the main predictors of death in PD subjects is also easy to demonstrate. In a community-based epidemiological survey of death caused over a 4-year period, Beyer et al found that twice as many PD patients (20%) die from pneumonia as in the general population (9%), possibly indicating that a rather small, but significant group of PD patients develop a severe end-stage parkinsonism that leaves them bedridden with increased risk of fatal infections (13). Wermuth et al compared causes of death in a cohort of PD patients to a control group, finding that lung infections and heart disease were principal causes of death and significantly higher in PD than in the control group (14). Nakashima et al found that pneumonia was the leading cause of death in their study group (40.9%) (15). Therefore, although with variable rates probably owing to different methods of data retrieval, pneumonia appears to be the foremost cause of death in PD. It also represents an important cause of hospital admission to emergency and nonneurological departments (16).

Many authors have extensively investigated the patterns of swallowing in PD individuals, outlining how the components of oral and pharyngeal phases may be differently affected with respect to the severity of limb motor impairment, the impact of drug therapy, and the stage of disease progression (17-21).

Some features seem to be shared by most PD patients: these are represented by a significantly prolonged oral transit time, negatively affecting oral clearance and lead-

ing to bolus residue accumulation in the vallecula or pyriform sinus, a delayed swallowing reflex, and a frequent phenomenon of silent aspiration, often appearing before patients are able to recognize any difficulty in swallowing. The signs are linked with disease severity and duration and have been shown to cause malnutrition and aspiration pneumonia or even death (22).

The diagnosis of swallowing impairment in PD subjects, as in any other category, relies on the collection of clinical and instrumental signs of either oral, pharyngeal, or esophageal phase involvement (23, 24).

The so-called bedside approach is especially useful to catch oral phase mechanism impairment, though it often underestimates deficits in the other swallowing phases (25, 26).

Videofluoroscopy has long been considered the gold standard for swallowing assessment, though it probably sees much more than is clinically relevant (21). Furthermore, videofluoroscopy lacks the temporal resolution of the electrophysiological study to evaluate the timing of each functional swallowing event, and fails to provide a complete functional evaluation of muscle activity as obtained by electromyogram (EMG) investigation (19). Recent studies suggest that the best results in the study of swallowing may be achieved by combining findings from the videofluoroscopic assessment and needle-EMG recording of cricopharyngeal muscle activation (27).

The act of swallowing may be divided into oral, pharyngeal, and esophageal phases (28). The initial oral phase is mainly voluntary and depends on food consistency, taste, hunger, and motivation. The pharyngeal phase consists of several coordinated actions, which transport the food from the oropharynx to the esophagus. These 2 phases are interrelated and partially voluntary. The swallowing reflex is under the control of the swallowing center in the brainstem. The esophageal phase is unconscious and under autonomic control. Although the cause and mechanism of dysphagia in PD remain largely unclear, many hypotheses have been put forward, involving either extrapyramidal or autonomic system structures (29). The cardinal symptoms of PD – tremor, bradykinesia, and rigidity – are primarily responsible for an oral phase impairment, as determined by delayed oral delivery, poor coordination of striated muscles, or reduced reaction to somatosensory stimuli. The frequency of such abnormalities in unselected PD samples is relatively low (about 30% across different studies), corresponding to the prevalence of subjects in the advanced disease stage (17, 30). The pattern is easily associated with symptom complaints by the patients, who spontaneously say that meal completion takes more than twice the time usually needed. According to the original hypothesis, oral phase involvement may be mainly ascribed to the impairment in

striated muscle activation due to levodopa-responsive mechanisms (31). It is not surprising, then, that the adjustment of drug therapy may lead to swallowing improvement in up to 50% of patients where oral phase impairment is the key component of dysphagia.

In the remaining subjects, thermal stimulation or tactile thermal applications, according to Lazzar's and Rosenbeck's techniques, have been found useful in increasing the swallowing competence in the oral phase (32).

Degeneration of the dorsal nucleus of the vagus and esophageal myenteric plexus is held responsible for pharyngeal and esophageal dysphagia, both swallowing phases being under autonomic control (33). Pharyngeal-phase impairment has been extensively studied by means of videofluorography, enabling researchers to detect delayed swallowing time, vallecula, and pyriform sinus residues in more than 70% subjects, with silent aspiration rates reaching 30% of cases (34, 35). A recent functional investigation of cricopharyngeal muscle activity during swallowing, performed through needle-EMG recording, described an impaired inhibition of such muscle activation even in early PD subjects (27).

Overall, a disruption of the normal sequencing of the pharyngeal phase of swallowing is assumed to follow the degeneration of the pedunculopontine tegmental nucleus (PPTN) and the consequent reduction in its inhibitory (cholinergic) activity on the bulbar swallowing centers (36-40). The cholinergic part of the PPTN has reciprocal connections with various nuclei of the basal ganglia, including the subthalamic nucleus, the globus pallidus pars interna, and the substantia nigra pars reticulata. Cholinergic outputs from the PPTN also project to the nucleus tractus solitarius, which is part of the medullary central pattern generators of swallowing.

The occurrence of pharyngeal component impairment in PD is mainly asymptomatic. If directly questioned, patients acknowledge their difficulties in coping with liquids, admitting they have to focus attention on swallowing, to avoid aspiration and cough. Drooling is a reliable predictor of increasing swallowing difficulties, since saliva leaks out of the mouth when it cannot be regularly swallowed (41).

The impairment in pharyngeal and esophageal components of swallowing being under the control of non-dopaminergic pathways is neither responsive to antiparkinsonian drug adjustment nor liable to be easily modified by rehabilitation strategies (42). The observed delay in the swallowing reflex, together with fragmentation of the pharyngeal swallowing sequences has been approached by means of a cueing strategy: some authors have described the efficacy of training based on coupling swallowing acts to the rhythm imposed by a portable metronome brooch. However, no carry-over effect has

been demonstrated, as always happens when using the cueing paradigm (41).

In a review concerning nonpharmacological swallowing therapy for the treatment of dysphagia in PD, the authors concluded that there was no evidence to support or refute the efficacy of the quoted approaches for improving swallowing (43). Further updates on this topic are expected from the completion of an ongoing randomized controlled trial comparing the effects of "chin down" posture with thickened liquids on the rates of aspiration and pneumonia, in dysphagic PD subjects.

## SWALLOWING DISORDERS IN ALS

Amyotrophic lateral sclerosis is the archetype of neurodegenerative disorders, where the progression of cell apoptosis in the context of pyramidal tracts and anterior spine horns rapidly leads to accumulating motor disability, communication disorders due to dysarthria, swallowing impairment, and, finally, death due to respiratory failure. About 60% of patients die within 3 years of disease onset, survival being shorter in elderly people and in those who exhibit a bulbar-type onset. Only 10% cases are still alive 10 years after disease start (44). The occurrence of bulbar signs (such as dysphagia and dysarthria) is associated with twice as high a risk of dying within 1 year as in subjects without a bulbar involvement (45). Recommendations for the best care provision to ALS patients underline the importance of early management of nutritional problems from the time of diagnosis, by giving the patients thorough information on the expected neurological decline and the oncoming needs for enteral nutrition. International guidelines recommend percutaneous endoscopic gastrostomy (PEG) in cases where dysphagia is complicated by increasing weight loss due to malnutrition and dehydration, and quality of life risks are severely worsened by frequent choking phenomena (46).

In selected patients, enteral nutrition by PEG has been acknowledged as an effective means of significantly increasing both life expectancy and well-being (47).

However, to guarantee the best outcome, timely intervention is recommended. In fact, since PEG application requires sedation, it can only be proposed for subjects whose lung capacity is not yet reduced by more than 50% of normal values. Therefore, swallowing function assessment should be made available to all ALS patients and scheduled on a regular basis to ascertain the very early signs of initial impairment, teach patients dietary style changes or postural strategies, alert them to the need for enteral nutrition, and gain their consent to the surgical procedure at the proper time (46).

The accomplishment of the quoted target may be on-

ly made possible through a multidisciplinary management including a neurologist with a physiatrist, speech therapist, and nutritionist. In fact, it has been argued that neurological clinical measures, such as the ALS Functional Rating Scale or the ALS Severity Scale (ALSSS), usually applied to score disease progression, are equally able to predict dysphagia impact and drive nutritional decisions (48).

In a descriptive study, Amadori et al compared ALSSS scores recorded in 25 dysphagic ALS patients with the results obtained through a standard clinical swallowing assessment performed by a speech therapist and checking for abnormalities in either oral or pharyngeal phase mechanisms (48). The Dysphagia Outcome and Severity Scale (DOSS) was adopted to rate swallowing impairment on a 7-level basis according to the following categories: 1-2 = severe dysphagia, need for enteral nutrition, 3-5 = moderate dysphagia, need for dietary style adjustment, and 6-7 = mild or no dysphagia, no need for compensatory strategies.

Ten out of 25 cases showed a bulbar-onset disease (B subgroup) and scored  $22 \pm 7$  on the ALSSS, after a mean  $2.0 \pm 1.0$  years of disease duration. The remaining patients, with non-bulbar-onset disease (NB subgroup), scored  $24 \pm 4.8$  on the ALSSS, with a mean disease duration of  $4.7 \pm 5.0$  years. Swallowing impairment was very severe in 100% of B subjects as compared with 71% of NB cases (mean DOSS score  $3.3 \pm 1$  in the B subgroup, vs.  $5.5 \pm 0.8$  in the NB subgroup; Mann-Whitney *U*-test,  $p = 0.0001$ ). Nutritional management recommended PEG for 4 patients (ALSSS,  $15 \pm 5$ ), dietary style adjustment in 15 cases (ALSSS,  $25 \pm 4$ ; range 32-18), and no changes for the remaining 5 patients (ALSSS,  $24 \pm 7$ ; range 35-18). No correlations could be found between ALSSS scores and nutritional strategies, apart from in cases with very severe neurological impairment.

The results of the study, as well as the indications included in many guidelines, stress the importance of an early referral of ALS subjects to a multidisciplinary team including a speech therapist and a nutritionist, to provide a professional assessment and follow-up of swallowing abilities and dietary requirements, and thus reduce the burden of disease as much as possible.

#### SUBACUTE-ONSET DYSPHAGIA: FUTURE NEEDS AND IMPLICATIONS FOR RESEARCH

The management of subjects with subacute-onset dysphagia is still hampered by a number of factors, such as

- a) the delay in the patient seeking specialized advice, due to poor symptom awareness;
- b) the heterogeneity of available diagnostic approaches,

which either are not adequately reliable (e.g., the 3-oz water swallow test) or are highly invasive and hence unsuitable as screening tests;

- c) the uncertain link between the parameters detected by the diagnostic investigations and the predictors of clinical risk, such as malnutrition and aspiration;
- d) the scarce availability of evidence-based efficacious and effective approaches to swallowing impairment, either among compensatory strategies (e.g., enteral nutrition and dietary style changes) or rehabilitation techniques (formal exercises).

Diagnostic uncertainty accounts for the much-discussed underestimation of dysphagia prevalence in the elderly population, whose rates probably exceed 60% in rest home residents (1, 22, 49).

According to Huffman, the causes of nonintentional weight loss are not recognizable in up to 25% of elderly subjects (50). For example, unrecognized dysphagia may lead to malnutrition, the correction of which by means of an enriched diet is prevented by an erratic nutrient intake. The growing number of recognized causes of dysphagia and their soaring prevalence in the elderly make it essential that care pathways related to dysphagia management be redesigned, with special attention to the phases of diagnosis and treatment choice (51, 52).

First of all, the cost-effectiveness of separate diagnostic approaches should be considered in view of the efficacy of therapeutic interventions dedicated to different pathological conditions.

From this perspective, the follow-up of swallowing impairment should be given great importance in ALS, as it may give a hint to the best time to provide the patient with enteral nutrition, thus giving patients a better quality of life as well as longer life expectancy.

With regard to dysphagic PD patients, the lack of any evidence concerning the possibility of positively influencing the disease course, comorbidity risks, and quality of life reduces the emphasis put on any diagnostic approach and indicates a need for further studies.

In conclusion, designing a care pathway dedicated to the management of patients showing subacute-onset dysphagia requires the accomplishment of the following crucial points:

- acknowledgement of the prognostic significance of dysphagia as a cause of either increased morbidity and mortality rate or decreased quality of life;
- assessment of the reliability, responsiveness, and prognostic relevance of given diagnostic approaches; definition of referral criteria for either screening tests (e.g., bedside examination, 3-oz water swallow test) or more invasive and resource-consuming investigations (videofluoroscopy, fiberoptic endoscopy);
- appraisal of therapeutic option impact on subjective

(well-being perception) and objective (complication rate) outcome measures, both in all dysphagic patients and in subgroups at higher risk for comorbidities;

- commitment of all the professionals needed to provide the best dysphagia treatment and nutrition management throughout the different disease phases;
- scheduling of timed interventions such as diagnostic work-ups, multidisciplinary assessments of dysphagic patients, referral for nutritional advice, dietary changes, nutrient supplementation, neurological and functional follow-up, and start of enteral nutrition.

Eventually, dysphagic subjects with neurodegenerative disorders will benefit from a disease management strategy where the symptom-oriented approach is replaced

by a patient-centered approach, tailored on the changing needs of individuals throughout the disease course and integrating different professional interventions, under the leadership of a case manager, toward an agreed target of quality-of-life improvement.

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