

# Swallowing dysfunctions in Parkinson's disease patients: a novel challenge for the internist

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## ABSTRACT

Parkinson's disease (PD) is a chronic neurodegenerative disorder with a typical movement pattern, as well as different, less studied non-motor symptoms such as dysphagia. Disease-related disorders in efficacy or safety in the process of swallowing usually lead to malnutrition, dehydration or pneumonia. Dysphagia and subsequent aspiration pneumonia are common causes of morbidity and mortality in those with PD. The aim of this review is to identify and evaluate the existing literature on swallowing disorders in PD and providing recommendations for clinical practice routine.

## Introduction

Dysphagia is a very frequent and highly relevant non-motor symptom in Parkinson's disease (PD) for quality of life (QoL), morbidity, and remaining lifetime, but it is yet widely underdiagnosed and underestimated regarding patients' centered care.<sup>1,2</sup>

Especially in early stages of the disease, the causal association between disease and swallowing disabilities remains unnoticed, this is due to the inability of caregivers and physicians to detect subtle swallowing problems and to a low self-awareness among PD patients. In order to prevent patients from serious negative consequences due to health issues (*e.g.*, aspiration pneumonia or malnutrition) as well as to the negative impact on their QoL, it is absolutely important to man-

age dysphagia timely and work closely together in a multidisciplinary team of specialists who are all involved in the patients' care system.<sup>3</sup>

## Pathophysiology of swallowing in Parkinson's disease

Physiologically swallowing includes 4 distinct phases: preparatory oral, oral or voluntary, pharyngeal, esophageal.<sup>4</sup> Patients with PD have poor oral control<sup>5</sup> and a high piecemeal deglutition rate.<sup>6</sup> Piecemeal deglutition may be due to poor oral motor control and/or oropharyngeal dysfunction, and although it is essential for a safe swallowing, it reduces the efficiency of swallowing.

The main swallowing difficulties in PD patients concern:<sup>7</sup> i) abnormal bolus formation; ii) multiple elevations of the tongue; iii) delayed swallowing reflex; iv) prolongation of pharyngeal transit time with different swallowing necessary to empty the material groove.

The pathologic mechanisms of oropharyngeal dysphagia, occurring in over 80% PD patients in the middle and later stages,<sup>8</sup> are not quite clear. Oropharyngeal bradykinesia and rigidity, incomplete cricopharyngeal relaxation, reduced cricopharyngeal opening, and delayed initiation of the swallowing reflex have been suggested as possible mechanisms of dysphagia in this patient population.<sup>9</sup>

The pathophysiology of dysphagia in PD remains unknown.<sup>10</sup> Hypokinesia and bradykinesia due to Parkinsonism can cause motor dysfunction of the tongue and impaired mastication.<sup>11,12</sup> Therefore, oral transit time is frequently prolonged.<sup>13</sup> In the pharyngeal phase, slow transit and pooling in the valleculae and pyriform sinuses may delay the swallowing reflex.<sup>14</sup> Aspiration and prolonged swallowing time are significant risk factors for aspiration.

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Furthermore, silent aspiration is one of the most common findings and an important predictive factor for aspiration in patients with PD.<sup>15</sup>

Multiple risk factors including swallowing function, decreased cough reflex (leading to silent aspiration), poor oral hygiene, impaired immunity, and reduced mucociliary transport are associated with the development of aspiration pneumonia in the elderly.<sup>16</sup>

Moreover, at the basis of the development of dysphagia in PD can be found the neural degeneration and the subsequent regeneration that characterizes the course of PD which manifests itself in the alteration of the morphology of the fibers of the pharyngeal muscles and of the associated histochemical and enzymatic activities:<sup>17</sup> i) presence of a considerable number of denervated and atrophic type I fibers; ii) small angular fibers; iii) reduced fiber diameter; iv) central position of the fiber cores; v) transformation of fast fibers into lenses.

Some factors are independent predictors of poor prognosis: sex, age, duration of the disease, level of education and presence of dementia.<sup>18</sup> In fact, these disorders are reported mostly in elderly males, with a minimum level of education, a long-term illness and the presence of dementia.<sup>18</sup> Dysphagia can cause fluctuating symptom in PD patients treated with levodopa (L-DOPA). PD patients may present *delayed-on* and *no-on* phenomena. Sato *et al.* have described in a case report that the *no-on* phenomenon can be caused by a posterior contractile dysfunction of the tongue. This can be improved by training the tongue and through transdermal rigotina administration.<sup>19</sup>

## Ab ingestis pneumonia

The penetration of ingested material into the airways was calculated in 22% of PD patients who, moreover, did not complain of disturbances.<sup>20</sup> According to a US report conducted between 1979 and 2010<sup>21</sup> ab ingestis pneumonia occurs in 3.6% of Parkinson's patients and is the most common cause of death (30%) followed by cardiovascular causes (21%), cancer (19%) and stroke (16%).<sup>22</sup>

Dysphagia should be an early warning sign of disease progression and shorter survival in patients with PD, due to insufficient medication intake, malnutrition, and dehydration.<sup>23</sup>

In order to preventing aspiration pneumonia, especially in the elderly population, there are some interventions, which are extremely important:<sup>24</sup> i) *nutrition interventions* concerning the introduction of the soft mechanical diet and the change in consistencies with the use of thickened liquids; ii) *positioning strategies* that can be summarized in the head-posture (intervention at no cost and potentially feasible in daily practice, but lacking evidence of effectiveness supported by the literature); iii) *drug therapy* with

amantadine and cilostazol (with positive effects on reducing the risk of pneumonia although they have numerous gastrointestinal and neurological side effects); iv) *oral hygiene programs* with tooth washing and mouth rinsing after each meal (insignificant efficacy requiring further studies with reduced risk of bias).

At the basis of the prevention of aspiration pneumonia in Parkinson's patients, however, there is the treatment of dysphagia<sup>7</sup> and more generally the management of swallowing disorders aimed at preserving safe oral feeding as long as possible.

## Therapy for dysphagia and swallowing disorders in Parkinson's disease

The number of reports on the effects of therapies for dysphagia in PD is still rather small.

The different types of therapy are grouped into four main therapy groups: pharmacologic, surgical, rehabilitative, and others.<sup>25</sup>

### Pharmacologic treatment

The first treatment proposal consists of pharmacological intervention through the use of dopaminergics, such as L-DOPA both in usual dose,<sup>26,27</sup> and in maximum tolerable dose,<sup>28</sup> although in literature there is still no consensus about the efficacy of such therapies in reducing swallowing dysfunctions. It is possible that patients experienced improved swallowing function after levodopa treatment due to a reduction of bradykinesia and rigidity of the tongue.<sup>29,30</sup>

Iwasaki *et al.*<sup>31</sup> described the positive therapy effects of traditional Chinese medicine *Banxia Houpo Tang* in improving the swallowing reflex of patients with PD.

Tison *et al.*<sup>32</sup> found that apomorphine improves swallowing abnormalities and restricts total swallowing time in a small subgroup of patients (eight patients) with PD and swallowing disorder; however, the interindividual variations and differential effects on the various swallowing stages must be investigated in a larger patient population.

### Surgical treatment

The treatments identified on surgical interventions concern the execution of the cricopharyngeal sphincterotomy<sup>33,34</sup> with excellent results (especially the relief of esophageal symptoms), however the sample was too small to have evidence of significant effectiveness within a larger population.

### Rehabilitative treatment (swallowing training)

Swallowing training consists of five motor function/behavioral exercises; the studies to determine the effects of this in PD are extremely rare.

Expiratory muscle strength training (EMST) could be one of the most advantageous treatments from an economic point of view in the management of this type of patient, in association with dopaminergic treatment and traditional swallowing exercises.<sup>35</sup> EMST is able to generate an increase in the forces produced by voluntary cough in those who undergo treatment and whether it can reduce incidence of long-term penetration or aspiration, thus reducing also associated mortality.<sup>36</sup>

Concerning the EMST, initial evidence is available regarding its efficacy in improving the functionality related to swallowing but it is necessary to confirm the preliminary results with further studies.<sup>37</sup> In the future it will also be necessary to investigate whether it is to be hoped that future research will involve larger samples of participants and investigate possible differences based on the different levels of disease severity, without excluding subjects at the initial stages.

Given the limited data available to us and the level of evidence achieved, however, EMST requires additional research programs before being referred to as the standard treatment to be proposed for dysphagia in Parkinson's patients.

### Other treatments

Other treatments are proposed, like the use of dental implants<sup>38</sup> combined with overdentures to improve chewing and pre-ingestion capacity.

The treatment with percutaneous injections of botulinum neurotoxin type A may be an effective and safe alternative to invasive procedures or may be a useful tool for identifying patients who might benefit from successful surgical myotomy.<sup>39,40</sup>

### Conclusions

Any treatment that can be proven, even the least scientific evidence in reducing incidence of aspiration pneumonia should be supported by further studies that confirm its validity.

It can be concluded that large randomized controlled trials with a multidimensional swallowing assessment are necessary to assess the effectiveness of the different types of dysphagia treatments in PD.

The research work ends with the reiteration of an important concept: even if generalizations about the treatment considered in the two reported studies are not yet possible, this is not to be considered as the statement of total lack of effect in reducing swallowing disorders and ensure greater airway protection in PD patients where there is still a positive trend after treatment.

Finally, it will be crucial to introduce outcome indices such as the QoL associated with these disorders

with the execution of the specific questionnaire in order to understand the true impact of treatment on patients' life.

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