

## Original Article

## The value of oropharyngoesophageal scintigraphy in the management of aspiration into the tracheobronchial tree in neurological patients

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## ABSTRACT

**Aim:** Dysphagia and bolus aspiration are two of the most frequent and invalidating symptoms of various neurological diseases. Swallowing disorders often lead to tracheobronchial aspiration with consequent pneumonia episodes. Aspiration pneumonia per se constitutes the most frequent cause of death in these patients, with mortality rate ranging from 20% to 62%. Oropharyngoesophageal scintigraphy (OPES) permits functional quantitative assessment of the different stages of swallowing, together with the detection and quantitative measurement of bolus aspiration. In this work, we analyzed the role of OPES in patients with different neurological conditions to evaluate swallowing and to detect and quantify bolus aspiration. **Material and methods:** We enrolled 43 neurological patients (25 women and 18 men, mean age  $67.3 \pm 12.4$  yr) complaining of dysphagia with suspected inhalation. All patients underwent OPES with <sup>99m</sup>Tc-nanocolloid using a liquid bolus first, followed by a semi-solid bolus. We evaluated the following parameters: Oral, Pharyngeal and Esophageal Transit Time, Oro-Pharyngeal Retention Index, Esophageal Emptying Rate, and Aspiration Rate (% AR).

**Results:** OPES detected some airway aspiration in 26/43 patients. 19 patients had tracheal aspiration (with a mean 18.1% AR) and the remaining 7 patients had bilateral broncho-pulmonary aspiration (mean 44.9% AR).

**Conclusions:** OPES is a feasible, repeatable and noninvasive method that allows quantitative assessment of bolus aspiration into the tracheobronchial tract, thus representing a useful and accurate tool to guide the most appropriate treatment and to monitor response to therapy in neurological patients with dysphagia.

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## El valor de la gammagrafía orofaringoesofágica en el manejo de la aspiración en el árbol traqueobronquial en pacientes neurológicos

## RESUMEN

**Objetivo:** La disfagia y la broncoaspiración de comida son 2 de los síntomas más frecuentes e invalidantes de diversas enfermedades neurológicas. Los trastornos de deglución producen una aspiración traqueo-bronquial y episodios de neumonía. La neumonía por aspiración constituye en sí misma la causa más frecuente de muerte en estos pacientes, con tasas de mortalidad entre 20–62%. La gammagrafía orofaringoesofágica (OPES) permite la evaluación funcional cuantitativa de los diferentes estadios de la deglución, junto con la detección y la cuantificación de la broncoaspiración. En este trabajo analizamos el papel de la OPES para evaluar la deglución y para detectar y cuantificar la broncoaspiración de comida en pacientes con variadas situaciones neurológicas.

**Material y métodos:** Se estudiaron 43 pacientes neurológicos (25 mujeres y 18 hombres, edad media  $67,3 \pm 12,4$  años) que presentaban disfagia y sospecha de inhalación. A todos los pacientes se les realizó OPES con <sup>99m</sup>Tc-nanocoloide usando primero un bolo líquido y después un bolo semisólido. Se evaluaron los siguientes parámetros: tiempos de tránsito oral, faríngeo y esofágico, índice de retención orofaríngea, tasa de vaciamiento esofágico, índice de retención orofaríngea, tasa de vaciamiento esofágico y tasa de aspiración (%AR).

## Palabras clave:

Traqueobroncoaspiración

Gammagrafía orofaringoesofágica

Disfagia

Neumonía por aspiración

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**Resultados:** La OPES detectó broncoaspiración en 26/43 pacientes. Diecinueve pacientes tuvieron aspiración traqueal (media AR 18,1%) y los restantes 7 pacientes aspiración broncopulmonar bilateral (media AR 44,9%).

**Conclusiones:** La OPES es un método no invasivo, factible y repetible que permite la evaluación cuantitativa de la aspiración de comida en el tracto traqueobronquial. Por ello, representa un procedimiento útil y exacto para guiar el tratamiento más apropiado y para monitorizar la respuesta terapéutica en pacientes neurológicos con disfagia.

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## Introduction

Dysphagia is defined as difficulty in swallowing food (semi-solid or solid), liquid, or both. Lots of neurological conditions may predispose a person to difficulty in swallowing (Table 1). Also radiation therapy damage can be considered as neurological damage, because it can produce sensory and motor denervation and fibrosis of the upper aero-digestive tract musculature and mucosa. The first two phases of swallowing are usually impaired in dysphagia caused by neurological disorders (being also defined as oropharyngeal dysphagia).<sup>1</sup> The impairment usually goes hand in hand with the primary disorder and dysphagia can appear with two different modalities. In some cases (as stroke and traumatic brain injury) there is an acute onset and an apparently favorable course. In other cases, as neurodegenerative diseases, a chronic and progressive impairment with more invalid consequences is presented. All forms are anyway associated with an increased risk of tracheobronchial aspiration, a condition that can be life threatening by itself (because of suffocation) or because of the associated aspiration pneumonia. Silent aspiration, which occurs as a physiological event also in normal subjects while sleeping, appears to be particularly frequent in patients presenting dysphagia of neurological origin, reaching 40–60% of subjects according to reports in the literature.<sup>2</sup> This event leads to an increase in morbidity and mortality of the patients affected,<sup>3</sup> as well as a deterioration in quality of life and a marked increase in public health spending.<sup>1</sup>

Pathophysiologic studies of dysphagia have involved overtime physicians from various specialties such as neurologists, gastroenterologists, otorhinolaryngologists, radiologists and nuclear medicine specialists.

An appropriate management of dysphagia would require a prompt diagnosis – based on the early identification of those patients having/or presenting risk of aspiration – and a characterization as best as possible of the impairment of each phase of swallowing (oral, pharyngeal, and esophageal phases).

There are few diagnostic examinations for dysphagia assessment.

Videofluoroscopy (VFSS) is considered the “gold standard” exam for determining the extent of the swallow disorder, enabling to detect each anatomic structure involved and to evaluate swallowing in a dynamic way.<sup>4</sup> It consists in recording fluoroscopic images which appear on the monitor during intake by the patient of a radio-opaque bolus. The technique enables a precise evaluation not only of the morphological features but also for the dynamics of the swallowing act, including its three phases. It is particularly indicated in cases of abnormalities of the mouth and esophagus, for objectively assessing the adequacy of airways protection during swallowing and it helps to detect compensatory strategies in pathological swallowing aimed at reducing the entity of tracheobronchial aspiration.

Fiberoptic endoscopic evaluation of swallowing (FEES) is an easy-to-perform examination, also representing a useful technique for bedside examination. It is performed with a fiberoptic rhinopharyngoscope for studying the physiopathology and to provide anatomic and functional details of swallowing, particularly the pharyngeal stage.<sup>5</sup> It is a well tolerated and inexpensive technique, and it is able to precisely evaluate cough reflex. FEES also enables visualizing the sites of bolus accumulation and possible related anatomical alterations. The main disadvantage of this technique is represented by the fact that there are no detailed information about oral and esophageal phases of deglutition.<sup>6,7</sup> Oropharyngoesophageal scintigraphy, recently introduced for studying dysphagia, permits both a functional and a semi-quantitative study of the various stages of swallowing, together with detecting tracheobronchial aspiration. Furthermore, tracheobronchial aspirate, when present, can easily be quantified.<sup>8–11</sup> In this study we demonstrated the ability of oropharyngoesophageal scintigraphy (OPES) to detect and quantify the presence of aspiration in a patient with dysphagia due to neurological impairment.

## Material and methods

We enrolled 43 consecutive patients (25 women and 18 men, mean age  $67.3 \pm 12.4$  yr), complaining of dysphagia secondary to neurological conditions and supposed to have inhalation. Patients all underwent OPES at our center. Twenty-five patients had amyotrophic lateral sclerosis, 9 with Parkinson's disease and 9 with stroke. All patients underwent OPES with radio-colloid suspension ( $^{99m}\text{Tc}$  albumin nanocolloid-Nanocoll®, GE Healthcare). Our protocol consists by evaluating liquid bolus first and semi-solid subsequently.

As a preliminary stage of the protocol, we employed non-radio-labeled water to test the patients about the procedure and to assess their ability to swallow the 10-ml liquid bolus required for the exam. The patient was placed in an orthostatic position, with the face half-turned in front of a dual-head, large-field-of-view (LFOV) gamma camera (Infinia Hawkeye®, GE Healthcare). Gamma camera was equipped with a low-energy, high-resolution (LEHR) parallel-hole collimator, with energy window settled at 140 keV ( $\pm 10\%$ ) and field-of-view from the oral cavity to the epigastric region (ideally the mouth of the stomach).

**Table 1**

Diseases associated with dysphagia and bronchial aspiration.

Neurological diagnoses and conditions associated with dysphagia and aspiration		
Cerebrovascular disease	Parkinson disease	Wallenberg syndrome (lateral medullary syndrome)
Head/spinal injury	Amyotrophic lateral sclerosis	Progressive supranuclear palsy
Anoxia	Huntington disease	Huntington disease
Myositis	Myasthenia Gravis	Multiple sclerosis
Guillain-Barre Syndrome	Alzheimer disease	Myotonic – muscular-oculopharyngeal dystrophy
Dementia	Progressive supranuclear palsy	

Modified from Radiographics 2006.

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