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Dysphagia of Neurological Origin – Amyotrophic Lateral Sclerosis

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Abstract

Amyotrophic lateral sclerosis (ALS) is a progressive neurodegenerative disorder of unknown etiology that affects upper and lower motor neurons resulting in progressive atrophy of skeletal muscles. There are two forms of ALS: spinal motor neuron injury and bulbar paresis. Dysphagia is a highly prevalent severe and invalidating symptom in ALS: almost 80% of ALS patients with bulbar paresis will develop dysphagia. Also, dysphagia is one of the most common and serious complications, with respiratory insufficiency, in patients with ALS as it exposes them to malnutrition, dehydration and aspiration pneumonia. These conditions are reported to be associated with a minor survival in patients with ALS. Screening for dysphagia must be performed in all ALS patients at diagnosis and during the follow-up to approach dysphagia as soon as possible. This chapter includes the latest developments in the assessment and approach of dysphagia in ALS patients.

Keywords: dysphagia, neurodegenerative disorder, amyotrophic lateral sclerosis, malnutrition, swallowing

1. Introduction

Amyotrophic lateral sclerosis (ALS) is a neurodegenerative disease that characteristically affects the upper motor neuron (located in the motor cortex) and the lower motor neuron (located in the brainstem and medullary anterior horn). As a consequence, muscular weakness ensues, which progresses to paralysis, spreading from one body region to another in a way that affects motor autonomy, oral communication, swallowing and breathing [1]. ALS is an irreversible, disabling chronic disease with serious complications.

ALS is the third neurodegenerative disease in incidence, after dementia and Parkinson's disease. It is, together with its variants, primary lateral sclerosis, progressive muscular atrophy, and progressive bulbar palsy, the most common motor neuron disease in adults. The incidence of ALS is between 1.5 and 2.5 new cases per 100,000 inhabitants per year, and the prevalence is between 4 and 6 people per 100,000 inhabitants, being relatively uniform in Western countries [2, 3].

The diagnosis of ALS is currently based on the Awaji criteria [4], respectively, the revised El-Escorial criteria [5]. Also, the Gold-Coast criteria have recently been proposed [6].

ALS occurs in two main forms: the central or bulbar form, also known as progressive bulbar palsy, and the peripheral or spinal form. In bulbar ALS, at least 80% of patients will develop dysarthria and dysphagia [7], while in the spinal or peripheral form, muscle weakness predominates, although dysphagia may appear in the evolutionary course.

Currently, there is no curative treatment, but there are some effective measures to prolong patient survival, such as nutritional management, whose aim is the prevention of malnutrition and the improvement of quality of life. Riluzole is the only medication approved for treatment of ALS by the United States Food and Drug Administration and the European Medicine Agency. Its mechanism of action is complex and includes inhibition of glutamate release, blocking of receptors for excitatory amino acids, inactivation of voltage-gated sodium channels, and stimulation of a G-protein-dependent signal transduction. Riluzole is generally well tolerated and may prolong survival by 2–3 months [8]. Recent reports suggest that riluzole could increase the survival of patients with ALS for up to 19 months [9].

Nonetheless, survival of ALS patients from diagnosis is 20% at five years after diagnosis of the disease [10]: mean survival of ALS is 3–5 years, with 5–10% living longer than 10 years [11]. The main causes of mortality are respiratory failure and malnutrition with dehydration [12, 13].

ALS patients frequently present malnutrition, this being an independent prognostic factor for survival [14]. The causes of malnutrition are the appearance of dysphagia, whose prevalence reaches 80% in the evolutionary course of ALS, as well as the decrease in intake due to loss of autonomy, muscle atrophy, fatigue and increased energy requirements.

The prevalence of malnutrition varies from 16 to 53% depending on the parameters used [15], the form of presentation of the disease and the moment in its evolutionary course. Therefore, a nutritional assessment is recommended in all patients diagnosed with ALS, whether bulbar or spinal, at the time of diagnosis of the disease [12].

The follow-up and nutritional approach of these patients is chronic, without considering the possibility of discharge or end of follow-up. However, there are no precise premises regarding follow-up (frequency of visits) [12]. Furthermore, it is important to bear in mind that the management of these patients is multidisciplinary (Pneumology, Neurology, Rehabilitation, etc.) and requires closer surveillance than other types of patients.

Swallowing is a complex act that relies on the correct coordination of motor and sensory systems of oral, pharyngeal and esophageal strictures. Dysphagia is defined as the difficulty in passing the food bolus from the mouth to the stomach caused by the anatomical or functional alteration of various structures involved in swallowing. It includes the behavioral, sensory and motor alterations that occur during swallowing, including the state of consciousness prior to the act of eating, the visual recognition of food and the physiological responses to the smell and presence of food.

Swallowing disorders can appear acutely or insidiously and progressively. Dysphagia is classified according to its etiology (mechanical or motor) or according to its location (oropharyngeal or esophageal).

In ALS patients, dysphagia is progressive, motor, and occurs both at the oropharyngeal and esophageal levels. Its prevalence is 30% at diagnosis, with an increasing incidence as the disease evolves, appearing in up to 80% of patients with ALS [7, 12].

The importance in the diagnosis of dysphagia lies in its complications, derived from a decrease in a reduction in the efficacy and safety of swallowing. Complications from dysphagia include malnutrition, dehydration, aspiration and pneumonia. Malnutrition and aspiration increase the risk of death by 7.7 times in ALS patients, hence the importance of its diagnosis and approach [11].

2. Physiopathology of dysphagia: focusing on ALS

Swallowing is a complex act that involves the coordination of multiple sensory and motor systems. During the oral phase, the tongue forms and holds a bolus on the anterior tongue. Currently, the posterior tongue prevents the food from entering the pharynx prematurely. After bolus formation, the posterior transport of the bolus is initiated by the anterior tongue pressing against the hard palate. In the pharyngeal phase, the posterior tongue retracts against the pharyngeal wall and contributes to the downward propulsion of the bolus [16].

ALS may present with a combination of spastic and flaccid weakness that can affect swallowing significantly. Dysphagia in ALS results from bulbar sensory-motor neurodegeneration, which is a pathognomonic feature of ALS [1]. Involvement of the motor nuclei located in the brainstem causes the characteristic bulbar muscle weakness and atrophy, leading to dysphagia. Oropharyngeal impairment of the tongue has been identified, but the underlying mechanisms of its motor dysfunction are not completely understood [17].

Impairment of the tongue seems to represent a major risk factor for aspiration [18]. One study showed a correlation between tongue pressure and the severity of dysphagia and physical performance in 39 patients with ALS [19]. Although swallowing pressures are known to be considerably weaker than maximum pressure exerted by tongue-palate contact pressure tasks, specific measures of maximum tongue strength have been shown to be associated with overall swallowing performance [20].

The occurrence of dysphagia in ALS patients is also related to impairments in the upper aerodigestive tract and respiratory and laryngeal muscles to the extent that they affect the expiratory phase of voluntary cough. There is a strong connection between poor effective voluntary cough and the presence of penetration/aspiration events [21].

One study looked into the pathophysiological mechanisms of dysphagia in 43 patients with sporadic ALS, using clinical and electrophysiological methods that objectively measured the oropharyngeal phase of voluntarily initiated swallowing, and compared them with those obtained from 50 age-matched control subjects [22]. Laryngeal movements were detected by a piezoelectric sensor and muscle electromyography (EMG) of submental muscles, while needle EMG recorded the activity of the cricopharyngeal muscle of the upper esophageal sphincter (UES) during swallowing. ALS patients with dysphagia displayed the following abnormal findings: 1) submental muscle activity of the laryngeal elevators, which produce reflex upward deflection of the larynx during wet swallowing, was significantly prolonged, whereas the laryngeal relocation time of the swallowing reflex remained within normal limits; 2) concerning the cricopharyngeal sphincter muscle, EMG demonstrated severe abnormalities during voluntarily initiated swallows. The opening of the sphincter was delayed and/or the closure occurred prematurely, the total duration of opening was shortened, and, at times, unexpected motor unit bursts appeared during this period; and 3) during voluntarily initiated swallow, there was a significant lack of coordination between the laryngeal elevator muscles and the cricopharyngeal sphincter muscle. These results point at two pathophysiological

mechanisms that cause dysphagia in ALS patients: 1) the triggering of the swallowing reflex for the voluntarily initiated swallow is delayed and eventually abolished, whereas the spontaneous reflexive swallows are preserved until the preterminal stage of ALS; 2) the cricopharyngeal sphincter muscle of the UES becomes hyper-reflexic and hypertonic. As a result, the laryngeal protective system and the bolus transport system of deglutition lose their coordination during voluntarily initiated swallowing.

Another study investigated the variations of esophageal peristalsis in 28 ALS patients with predominantly bulbar or predominantly pseudobulbar clinical presentation by using esophageal manometry (EM) [23]. Swallowing was initiated with 5–10 mL of water (wet swallows) and saliva (dry swallows) and repeated at 30-second intervals. The manometric parameters were measured automatically and visualized by the computer system. In patients with pseudobulbar presentation, an increase of the resting pressure value in the UES >45 mmHg, a wave-like course of resting pressure, and toothed peristaltic waves were observed. In patients with bulbar presentation, a low amplitude of peristaltic waves <30 mmHg (mean: 17 ± 5) was recorded, without signs of esophageal motility disturbance at onset or during progression. EM procedure allows objectively distinguishing dysphagia in ALS patients due to bulbar syndrome from dysphagia due to pseudobulbar syndrome. It is crucial to identify patients with pseudobulbar clinical presentation due to their high risk of aspiration.

When considering management and treatment of dysphagia, visualization of physiology is the only reliable method to understand the pathophysiology of this condition [24].

3. Dysphagia assessment

The diagnosis of dysphagia is of utmost importance, given the burden of this symptom, causing malnutrition, dehydration, aspiration pneumonia, respiratory failure, and reduced quality of life. Aspiration and malnutrition increase the risk of death [25]. Early identification of dysphagia facilitates improved management, reduced risk of malnutrition and postponed percutaneous endoscopic gastrostomy (PEG) tube placement [26, 27]. The search for dysphagia as early as possible is key in order to prevent its complications.

The diagnosis of dysphagia is more easily performed at multidisciplinary clinics. A dysphagia assessment should be performed in all patients with ALS, both at diagnosis and during follow-up, with a recommended frequency of every 3 months, as part of a complete clinical and neurological evaluation [12].

Dysphagia can be underestimated in ALS due to progressive adaptation to the slow bulbar deterioration and given the inconsistencies in what patients report about the condition. Often, oral stage deficits like difficulties in chewing or oral residue are not reported by the patient until pharyngeal stage deficits, such as coughing or choking, are observed.

A clinical swallow evaluation for suspected dysphagia involves medical history, physical inspection of swallowing, instrumental evaluation, pulmonary function, and bulbar function. However, most importantly, a screening test for dysphagia should be carried out.

Medical history. This includes the reporting of symptoms related to dysphagia, kind of diet, assistance with feeding, changes in body weight, coughing or choking with meals, length of time needed for food intake and saliva management. A validated questionnaire to assess these symptoms is the Eating assessment tool 10 (EAT-10), which has been validated for use in ALS [27]. This study reported high

clinical utility and ability to detect aspiration risk in ALS (86% sensitivity, 76% specificity and 95% negative predictive value). However, the validation of the test was performed only against penetration and aspiration scores on the videofluoroscopic swallowing study (VFSS) and not against any overall parameter of swallowing efficiency and safety. The kind of diet can be evaluated by the Neuromuscular Disease Swallowing Status Scale (NdSSS) and the Swallowing subscale on Amyotrophic Lateral Sclerosis Severity Scale (ALSSS). However, these scales do not detect all the patients with alterations in swallowing [28]. An important parameter related to dysphagia and intake is weight loss, which is, therefore, mandatorily recorded at all visits. Moreover, it is important to remember that weight loss and dietary intake are associated with more than just dysphagia.

Physical inspection of systems involved in swallowing and swallowing musculature should go beyond the mere observation of swallowing competence with test swallows. A dysphagia/aspiration screening evaluation is useful when determining the dysphagia risk; however, only limited validation has been completed in ALS. One study validated the volume-viscosity swallowing test (V-VST) against VFSS in 20 ALS patients and reported 93% sensitivity and 80% specificity, respectively [29]. The V-VST is a screening evaluation that involves determining safety and efficiency of swallowing, following the administration of multiple volumes and viscosities of liquids. Another method is the sequential water swallowing (SWS), which involves drinking 100 ml of water in a single, uninterrupted swallow. One study reported that 43% of patients with ALS have a disorganized pattern in their sequential swallows [30].

Instrumental evaluation, such as VFSS or functional endoscopic evaluation of swallow (FEES), is used to visualize the swallowing physiology. These techniques are essential and are the most commonly used, being considered the gold standard in the exploration of dysphagia in ALS, due to the high risk for silent aspiration that these patients have. In fact, one study suggests that up to 55% of ALS patients may present with silent aspiration [31]. VFSS can be used to evaluate problems in the oral phase of the swallowing process, and intradeglutitive silent aspiration can be detected. The interpretation of VFSS results can be done with the videofluoroscopic dysphagia scale (VDS), which contains 14 categories that represent oral functions (lip closure, mastication, bolus formation, premature bolus loss, apraxia, and oral transit time) and pharyngeal functions (pharyngeal triggering, laryngeal elevation, epiglottic closure, pharyngeal transit time, pharyngeal coating, vallecular and pyriform sinus residues, and tracheal aspiration) [32]. A modified version of VSD (mVSD) has been developed to overcome low inter-rater reliability of some categories in the VDS [33]. FEES is a valid, repeatable, and low-cost alternative, used to directly visualize the swallowing process and the saliva movement, and it is able to evaluate pharyngo-laryngeal sensitivity in addition to motility [34]. Other instrumental methods are manometry, in addition to VFSS, electromyography of submental, laryngeal, pharyngeal and diaphragmatic nerves, esophageal scintigraphy [35], tongue sonography and electromagnetic articulography.

Pulmonary function, generally assessed with forced vital capacity (FVC) and cough function, must be explored in patients with dysphagia. Patients with deteriorated pulmonary function are more likely to aspirate.

Bulbar function consists of the evaluation of the anatomy and physiology of head and neck structures involved in swallowing, including an evaluation of the cranial nerves essential for swallowing. The Centre for Neurologic Study Bulbar Function Scale (CNS-BFS) is a useful metric for assessing bulbar function. Among bulbar muscles, the tongue musculature appears to be disproportionately more affected by ALS [36], and tongue strength is a prognostic indicator of survival at

the time of ALS diagnosis [37]. Besides, measuring the maximum tongue strength is useful for early detection of dysphagia in ALS [38]. Other important signs of bulbar impairment are weak cough and dysarthria, which should be investigated.

It is imperative to derivate to a speech-language pathologist (SLP) if any bulbar dysfunction is identified. SLP plays an important role in the care of patients with speech, language, or swallowing difficulties that can result from a variety of medical condition.

One of the ways to improve reliability of clinical evaluations is to use standardized and validated protocols. A comprehensive assessment protocol, such as the Mann Assessment of Swallowing Ability (MASA), may be useful to carry out research in the ALS population. MASA, developed and validated for stroke, includes a detailed oral mechanism examination, cranial nerve testing and swallowing function evaluation [39].

Despite this, there is a lack of studies related to the diagnosis of dysphagia in patients with ALS, which is reflected in a significant variability and inconsistency in the management of dysphagia in ALS, as shown in a survey of current clinical practice patterns at 38 ALS centers in the United States in 2017 [40]. In another survey study performed in 2020, 88.9% of SLP performed an instrumental dysphagia evaluation in ALS patients, although the timing of when the evaluation occurred varied significantly; 42.2% of the clinicians carried it out at baseline even prior to the appearance of any bulbar symptoms [41].

4. Dysphagia and nutritional management

4.1 Dysphagia treatment

The aim of dysphagia treatment is to attain an oral diet with safe (to avoid respiratory infections and aspiration pneumonia) and effective swallowing (to maintain an adequate level of nutrition and hydration). Several postural, hygienic and dietary measures must be adopted to achieve this aim along with rehabilitative treatment.

4.1.1 General recommendations

The following postural and hygienic measures are included [42]:

- The environment must be comfortable and calm, which favors concentration, avoiding distractions during the meal.
- Do not start feeding if the patient is sleepy or restless, or if he/she is tired (avoid physical therapy and previous examinations).
- Sufficient time for food intake must be guaranteed.
- The proper position when eating is sitting with one's back straight, feet flat on the floor and the head slightly tilted forward when swallowing. If a person is unable to get out of bed, he/she should be positioned as upright as possible. Food intake should not take place while the head is tilted back.
- Self-feeding is preferable: the patient should feed him-/herself. This reduces the risk of aspiration, but the patient should always be under the supervision of a family member.

- The type of spoon indicated must be used: soup spoon, dessert spoon – candy – or coffee spoon.
- It should be checked that the previous spoonful has been swallowed before another one is given.
- Syringes or straws should not be used.
- Good oral hygiene must be kept to avoid respiratory infections in case of infection. If dentures are worn, they must be in place and tight.

4.1.2 Rehabilitation treatment

Rehabilitation treatment should be carried out whenever possible so that the patient can maintain an adequate oral intake to a greater or lesser extent. Postural maneuvers should be recommended to protect the airway during swallowing [12]. There is no strong evidence in the literature for dysphagia intervention in patients with ALS. Thus, rehabilitation treatment should be individualized. Aspects that influence the selection of the most suitable technique for each patient should be evaluated, such as the patient's cognitive status, behavioral and emotional aspects, degree of fatigue and family support. Based on these criteria, the most rehabilitative technique will be selected for each patient. Some rehabilitation techniques are postural strategies, sensory enhancement strategies (such as mechanical tongue stimulation, bolus changes in volume, temperature, and flavor, thermal stimulation, and changes in taste or acid flavor), neuromuscular practice, compensatory swallowing maneuvers and facilitation techniques.

Some compensatory swallowing maneuvers have been studied in patients with ALS. The chin-tuck posture was found to be useful in most cases, given that it offers a valuable protection mechanism for the airways by opening the valleculae and preventing penetration into the larynx [43]. The indication of the other maneuvers differs according to the mechanism involved in relation to disease characteristics and progression. Thus, hyperextended head posture is indicated in the absence of tongue pumping. If there is hypertonicity, incomplete release, or premature closure of the UES, head rotation is indicated [43]. However, current clinical guidelines do not suggest specific postural maneuvers [12].

Also, saliva could interfere with the management of dysphagia. However, the current evidence to recommend pharmacological treatments such as antimuscarinics in affected patients is low. There is no evidence linking the treatment of saliva issues with the improvement of dysphagia [12].

4.2 Nutritional management

The aim of nutritional management in patients with ALS is to prevent and/or treat malnutrition, to reduce the risk of aspiration, to prevent morbidity and mortality associated with malnutrition and dysphagia, and to improve quality of life. The nutritional approach in these patients includes the early detection of inefficient food intake, the need to adjust the consistency of the diet and, if oral feeding is not possible, the early indication of enteral nutrition by gastrostomy [12].

The nutritional approach modality is carried out according to the clinical situation, being conditioned in these patients by the safety and efficacy of swallowing and by the presence or absence of malnutrition.

In a malnourished patient or a patient being at nutritional risk, in whom oral feeding is possible, the first step is to optimize the diet and reduce the risk of aspiration [12].

The diet must be complete and cover the caloric-protein requirements of each patient. Energy requirements should be estimated as approx. 25–30 and 30 kcal/kg/day in ventilated and non-ventilated ALS patients, respectively [12]. Protein requirements should be calculated at a rate of 1–1.2 g/kg/day [44].

The diet composition for ALS patients does not differ from that of the general population with regard to the recommended macro- and micronutrients distribution [45–50]:

- Proteins: 15–18% of total energy intake.
- Carbohydrates: 55–60% of total energy intake.
- Fats: 30–35% of total energy intake.
- Fiber: fiber-rich diet is recommended, with contributions equal to or greater than 25 g/day.
- Water: it is advisable to ensure a water intake of at least 1 ml/Kcal/day, to prevent dehydration.
- Micronutrients: following the recommendations for the general population according to age and sex of the patient [46–50].

Dietary counseling and modification of food texture is a fundamental aspect of dysphagia treatment. Dietary modification alters the texture of both liquid and solid foods. These modifications should be based on each patient's swallowing capacity and must be regularly evaluated. Dietary modification allows achieving a better nutritional status and better quality of life in patients with special nutritional requirements.

There are multiple recommended methods for modifying the texture of solids and liquids. The *International Dysphagia Diet Standardization Initiative* (IDDSI) [51] establishes five levels of drink thickness (thin plus four levels of thickness) and five levels of food texture (regular plus four levels of modification):

- Texture levels for solid foods: regular, soft, and bite-sized, minced, and moist, pureed and liquidized.
- Texture levels for liquids in the treatment of dysphagia: thin, slightly thick, mildly thick, moderately thick and extremely thick.

Once the diagnosis of dysphagia has been made, the most appropriate solid and liquid food texture for the patient will be established, as well as the volume in which it should be administered.

Dietary modification includes high nutritional value ground or easy-to-swallow diets; texture modifiers, such as thickeners, gel waters or thickened beverages; and diet enhancers (food or nutrient modules) [52]. Also, certain foods should be avoided since they pose a high risk of choking, i.e., foods with double textures, dry or crunchy foods, sticky foods, foods that lose liquid when being chewed, and fibrous and/or filamentary foods.

Thickener modules are products with the ability to thicken, composed of modified starches or gums or a mixture of both, available as powder and with a

neutral flavor. They are exclusively intended to increase the consistency of liquid foods. Thickeners composed exclusively of gums preserve the natural appearance of the liquid (unlike those that contain starches) and, therefore, improve the compliance of the patient with dysphagia.

If these dietary modifications do not allow maintaining an adequate nutritional state, oral nutritional supplements (ONS) will be administered, in addition to a modified diet.

Nutritional supplementation is recommended for ALS patients who do not cover their nutritional requirements with an enriched diet. However, there is insufficient data to affirm that oral nutritional supplementation can improve survival in ALS patients [12]. There are no specific formulas for patients with ALS. Hypercaloric formulas with fiber and high viscosity are generally recommended to prevent constipation and reduce the use of thickeners. Thickened ONS have been marketed in recent years and are suitable for patients with difficulties in swallowing, requiring a level 3 consistency or more.

All these measures, together with the general recommendations and the rehabilitative treatment of dysphagia, are aimed at optimizing safe oral intake. However, dysphagia in ALS patients is generally progressive. Thus, if dysphagia makes oral nutritional intake impossible or the patient is severely malnourished, enteral nutrition may be required. Enteral nutrition will preferably be administered by gastrostomy tube [12].

PEG is the most widely technique and is performed under endoscopic control. Its placement and use are well tolerated by the patient and allows them to meet their nutritional needs.

The timing of PEG placement is controversial.

However, there are studies that recommend the placement of a PEG in ALS patients when forced vital capacity is still greater than 50% [53], since a lower percentage would indicate a greater deterioration in lung function that could increase the risk of complications during the procedure. The American Academy of Neurology [54] recommends rejecting gastrostomy when the FVC is below 30% and considers other forms of palliative care. However, several studies show that gastrostomy could be performed safely in patients with insufficient respiratory function [55–57]. The current clinical guidelines [12] do not take a clear position and allow recommendation, respectively, rejection of gastrostomy based on FVC. The reason is that ALS patients with dysphagia, particularly those with primary bulbar involvement, may have poor spirometry performance due to orofacial muscle weakness.

However, early gastrostomy implantation prevents the development of disease complications and improves the quality of life of these patients [58] but has not clearly shown a benefit in patient survival [59]. However, patients who still maintain oral intake tend to be reluctant to place it early.

In any case, the timing of the PEG placement must be agreed with the patient and family, respecting their wishes [12].

5. Conclusions and recommendations

- ALS is a complex disease, and its management requires a multidisciplinary approach that includes the figure of endocrinologists, speech therapists, pharmacists, nurses, nutritionists, and speech therapists.
- The prevalence of malnutrition in patients with ALS is high, in part, due to the high prevalence of dysphagia in these patients.
- A nutritional assessment should be carried out at the diagnosis of the disease and periodically to prevent and treat malnutrition.

- Screening for dysphagia should be performed at the diagnosis of the disease and regularly every 3 months to avoid possible complications.
- Video swallowing is the test of choice for the diagnosis of dysphagia in patients with ALS since it allows early signs to be detected, although V-MECV is a safe and effective alternative.
- The diet must be adapted at all times. The use of dietary counseling and the use of thickeners enables an individualized and safe nutritional intervention, adapting the texture of liquids and solids according to the efficacy and safety of swallowing for each patient.
- ONS can be used to supplement and reinforce the oral diet, making them a useful tool to prevent and treat malnutrition in patients with ALS. However, current legislation does not provide for funding for oral enteral nutrition formulas unless they are administered by tube or ostomy.
- Gastrostomy is a safe method of eating. The time of placement must be agreed with the patient since it is not without risks. There is no specific formula for patients with ALS, but it is recommended that it be hypercaloric and rich in fiber.

Conflict of interest

The authors declare no conflict of interest.

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