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Dysphagia Associated with Neurological Disorders

Vadim I. Ershov

Abstract

Neurogenic dysphagia is characterized by problems with neural control of swallowing caused by various neurological diseases: vascular diseases, traumatic diseases, neoplasms, infections, neuromuscular diseases, and others. In patients of intensive care units after long-term intubation and extubation may evolve “postextubation dysphagia”, characterized by the “learned non-use” phenomenon. Neurogenic dysphagia is a component of bulbar or pseudobulbar palsy, depending on the level of the neurological lesion. Diagnoses of neurogenic dysphagia include clinical examination (water swallow test), videofluoroscopy, upper gastrointestinal tract endoscopy and manometry, fiberoptic endoscopic evaluation of swallowing, a grade of Penetration-Aspiration Scale, and Fiberoptic Endoscopic Dysphagia Severity Scale. Dysphagia complications (malnutrition, dehydration, weight loss, aspiration, and respiratory tract obstruction) associated with bad functional recovery and life prognosis, so neurogenic dysphagia need a complex treatment: correct feeding pattern of caloric value and consistency, methods of oral cavity mucosa sensitivity stimulation, swallowing process stimulation, physiotherapeutic treatment methods (electrical stimulation of the larynx and tongue root), logopedic exercises therapy, surgical correction, lifestyle correction, and others. Sometimes it is a need for replacement therapy method by nasogastric tube and percutaneous endoscopic gastrostomy, parenteral feeding in several cases. Neurogenic dysphagia patient rehabilitation includes the “swallowing enhancement” method with optimal food consistency and training method after correct preparation of the oral cavity for swallowing. Neurogenic dysphagia patient oral feeding requires correct technique and contact with the patient for safety and efficient recovery.

Keywords: swallowing, dysphagia, stroke, rehabilitation

1. Introduction

Dysphagia is difficulty swallowing. Dysphagia is common in patients with neurological disorders. It can result from damage to the central or peripheral nervous system, as well as muscle and neuromuscular junction disorders. Neurogenic dysphagia often leads to serious complications including pulmonary aspiration, dehydration, and malnutrition. Dysphagia negatively affects the course of the disease and its outcome. Ethinienias can usually be prevented if dysphagia is detected early and treated correctly. The most common cause of neurogenic dysphagia, however, is stroke [1].

2. Physiological aspects of the swallowing process

Swallowing is a sequence of coordinated voluntary and involuntary (reflex) movements that push contents of the oral cavity into the esophagus and the stomach. It is a complex process consisting of coordinated movements of the jaw, the soft palate, and the esophagus muscles. The process involves the olivary nuclei and the cerebral cortex [2]. A person swallows approximately 600 times per day. Nearly 200 times while eating, 50 times while sleeping, and 350 times in all other cases. In most cases, swallowing is performed unconsciously [3].

The process of swallowing can be divided into four phases: oral, oropharyngeal, pharyngeal, and esophagopharyngeal. During the first (oral) phase, food is delivered into the oral cavity. Food is chewed, it is moistened with saliva, and a food bolus is formed [3, 4].

During the second (oropharyngeal) phase, the food is accumulated at the back of the tongue, chewing is stopped, and the tongue lifts up and pushes the food bolus through the pharynx into the middle portion of the pharynx (oropharynx). At the same time, the longitudinal muscles of the tongue and the mylohyoid muscles contract and press down the tip, back, and root of the tongue sequentially to the hard palate. The tongue is pushed backwards. The soft palate lifts up as to close down the nasopharynx. The pharynx and the hyoid bone move forward and up. The epiglottis moves back and down as to close down the entrance to the trachea. Breathing stops. The pharynx contracts [5].

During the third (pharyngeal) phase, the food bolus moves down into the middle portion of the pharynx, where the middle pharyngeal constrictor and the inferior pharyngeal constrictor contract, ensuring the bolus is squeezed and pushed downwards. At the same time, the larynx and the hyoid bone lifts up, enabling faster food bolus passing through the middle portion of the pharynx to the inferior portion. At the moment of swallowing, the reflex response enables expansion of the esophageal entrance, and the pharyngeal constrictors push the food bolus through the pyriform sinuses into the esophagus [5, 6].

During the fourth (esophagopharyngeal) phase, the upper esophageal sphincter relaxes. The food bolus enters the esophagus. The esophagus contracts sequentially. The inferior esophageal sphincter opens. The food bolus enters the stomach [6].

The first phase is voluntary, while the others are involuntary. Cranial nerves IX, X, XI are involved at all stages of swallowing [7].

Dysphagia (from dys- + Greek “phagein” meaning to eat, to swallow) is a clinical symptom of swallowing dysfunction: difficulty or painful passage of a food bolus from the oral cavity to the stomach [8]. Dysphagia can occur both as an independent condition or as a part of complex syndrome. Thus, dysphagia is the most important element of a bulbar or pseudobulbar palsy. Dysphagia is a subjective perception of difficulty swallowing.

Swallowing disorders are signs of various diseases. It is one of the key problems in diffuse and focal brain injuries [9]. Dysphagia occurs in 27.2% of elderly, who can take care of themselves; in 47.4% of elderly patients in intensive care units; in 51% of persons needing assistance. Dysphagia develops in 13–57% of patients suffering from dementia, in 19–81% of patients with Parkinson’s disease, in 44–60% of patients with neurodegenerative diseases. Neurogenic dysphagia occurs in 25–65% of patients after stroke, provided that mortality rates among tube-fed patients with post-stroke dysphagia vary from 20 to 24% [2, 10]. In 15–17% of cases, difficulty swallowing develops after posterior fossa brain tumor surgeries and represents one of dangerous postoperative complications. Nearly 60% of patients experience difficulty swallowing after extubation [11, 12].

Dysphagia has a negative impact on the quality of life. It leads to severe respiratory complications; it becomes the cause of dehydration, metabolic disorders, and cachexia. Dysphagia increases disability, significantly worsens prognosis, and complicates patient rehabilitation. Dysphagia is a significant risk factor for the development of aspiration pneumonia [13].

3. Dysphagia classification

Dysphagia is commonly divided into esophageal and oropharyngeal.

Based on the functional mechanisms of disease development, dysphagia is classified into:

- neurogenic (motor, high)
- organic or mechanical
- psychogenic

In addition, all types of dysphagia can be divided into:

- acute
- chronic

Based on the disease course, dysphagia can be:

- intermittent
- persistent
- progressive, with increasing clinical symptoms

4. Pathogenesis of neurogenic dysphagia

In most cases, neurogenic dysphagia is oropharyngeal [14]. Neurogenic dysphagia is characterized by problems with neural control of swallowing caused by various neurological diseases.

The most common cause of neurogenic dysphagia development is a stroke [9–10, 15, 16]. Dysphagia can also occur in case of traumatic brain injury, brain tumors, encephalitis, botulism, and rabies. This type of pathology is observed at late stages of Parkinson's disease, Alzheimer's disease, amyotrophic lateral sclerosis, other neurodegenerative diseases, severe myasthenia gravis, multiple sclerosis, Guillain-Barré syndrome, and other disorders.

On rare occasions, neurogenic dysphagia can be the sole manifestation. However, in most cases it is a component of bulbar or pseudobulbar palsy (**Tables 1 and 2**).

Bulbar palsy occurs in case of bilateral or unilateral injury of cranial nerve nuclei IX, X, and XII and their roots. Isolated nuclear palsy is not common due to close proximity of anatomical structures of the caudal part of the medulla. Bulbar palsy elements are also included in some alternating syndromes. By its nature, bulbar palsy is peripheral paralysis of the pharynx. In addition to dysphagia, bulbar palsy is

Bulbar dysfunctions	Sensitivity of pharyngeal mucosa	Swallowing function	Epiglottis position (evaluation of the epiglottic paresis grade)
Grade 1	Partially preserved	Preserved	Upper (normal)
Grade 2	Partially preserved	Partially impaired	Upper
Grade 3	Not observed	Impaired	Upper
Grade 4	Not observed	Grossly impaired	Medium
Grade 5	Not observed	Not observed	Lower (epiglottic paralysis)

Table 1.
Bulbar dysfunction scale.

Variant	Clinical profile
1st	Partially preserved sensitivity of the laryngeal mucosa and the epiglottic mobility; the swallowing function is preserved. On rare occasions, choking starts when liquid food is swallowed; patients do not require tube feeding.
2nd	Mild impairment of swallowing function with partially preserved sensitivity of the laryngeal mucosa; patients experience significant limitations. These patients can be fed by small portions (using a teaspoon) with food of cream, puree, and jelly-like consistency. When a patient has impaired critical judgment and weak ability to concentrate on performed actions, a need for tube feeding arises.
3rd	Severe impairment of laryngeal mucosa sensitivity and severe impairment of swallowing function, which require tube feeding. This variant is the most dangerous in terms of underestimation of case severity, because the epiglottis is in its upper position and it does not block breathing. Aspiration of the oropharynx contents into the trachea is common. Due to impairment of laryngeal and tracheal mucosa sensitivity and cough reflex suppression, aspiration is manifested at late stages in the form of respiratory failure and rapidly progressive pneumonia.
4th	Severe impairment of laryngeal mucosa sensitivity, severe impairment of swallowing function; the epiglottis is in its middle position and usually does not block breathing. In this variant, aspiration is manifested quite soon after failure of respiratory tract protection in the form of respiratory failure and grunting breathing.
5th	Severe impairment of laryngeal mucosa sensitivity, no swallowing function. The epiglottis rests at the inferior wall of the larynx, i.e., in its lower position. The glottis can be examined only using a fiberscope or via direct laryngoscopy (during intubation). Respiratory failure in such patients is usually manifested immediately after failure of respiratory tract protection (extubation) in the form of difficulty breathing.

Table 2.
Variants of bulbar dysfunctions (swallowing function).

characterized by dysarthria (speech disorder resulting from an injury of the nerves responsible for articulation), atrophy of the pharynx and tongue muscles, and aphonia. As a rule, breathing pattern disorders (aspiration syndrome, Lambert–Eaton myasthenic syndrome, respiratory failure) develop in critically ill patients suffering from bulbar palsy, which often leads to death [17]. This is caused by close proximity of the caudal group of cranial nerve nuclei to the respiratory and vasomotor centers [7].

Pseudobulbar palsy is a neurological syndrome caused by bilateral disturbance of the corticonuclear tracts. In contrast to bulbar palsy, pseudobulbar palsy is central paralysis of the pharynx. Pseudobulbar palsy is characterized by the same triad of symptoms as bulbar palsy: dysarthria, dysphonia, and dysphagia. However, in pseudobulbar palsy, swallowing disorders are less severe: there is no muscles atrophy, primitive oral reflexes are present, and pharyngeal reflex does not

disappear. Pseudobulbar palsy is characterized by compulsive crying or laughing. Pseudobulbar palsy can be often combined with signs of central hemiparesis or tetraparesis, due to the pyramidal tracts involvement [6, 7, 18].

A special form of oropharyngeal dysphagia called “postextubation dysphagia” (PED) was first observed in 1991 during myography of oral cavities of extubated patients. PED is one of the signs of post-intensive care syndrome (PICS) [2, 19–21]. The pathogenesis of PED is characterized by the “learned non-used” phenomenon characterized by three-phase swallowing impairment associated with long-term intubation (>48 h) or due to the absence of subglottal pressure in case of a cannula bearing [17, 22].

5. Neurogenic dysphagia diagnoses and monitoring

Dysphagia assessment procedures are selected depending on patient characteristics, severity of swallowing disorder, and procedure availability. Patients with stroke shall be screened for dysphagia during the first 24 hours after the disease onset and before oral eating [9, 23].

Swallowing assessment protocol was developed by the American Speech–Language–Hearing Association (ASHA). The main tests for oropharyngeal dysphagia assessment are the following ones:

- Water swallow test (three-swallow test): inexpensive and potentially useful basic screening test together with the data obtained from medical history and physical examination. The test has prognostic sensitivity of >95% as applied to detection of dysphagia occurrence [24, 25].
- Videofluoroscopy (“modified barium swallow”), which is a gold standard for oropharyngeal dysphagia assessment. The swallowing process is video recorded during fluoroscopy. Monitoring of patient’s swallowing motions is provided. This procedure can be beneficial in predicting the risk of aspiration pneumonia [26].
- Upper gastrointestinal tract endoscopy. Endoscopy is not a sensitive method for detection of impaired swallowing function and is not effective for aspiration detection. At the same time, this method is effective for dysphagia monitoring [27].
- Fiberoptic endoscopic evaluation of swallowing (FEES), which is a modified method that includes visual examination of the larynx and pharynx structures using flexible transnasal fiberoptic endoscope when a patient is eating or drinking. This method is the most commonly used in real clinical practice [28].
- Overall estimate of dysphagia severity is based on summing up PAS and FEDS grades (**Tables 3–5**) [15, 27].
- Automated impedance-manometry (AIM), which is combination of impedance-manometry and high-resolution manometry. This method provides valuable diagnostic information. These measurements represent reliable prognostic method of aspiration [10, 29].
- High-resolution pharyngoesophageal manometry, which is quantitative assessment of pressure and time of the pharynx contraction and time of upper esophagus relaxation. It can be used in combination with videofluoroscopy in order to gain better understanding of involved movements and pressure [30].

Grading	Description of respiratory tract, larynx, and trachea state
1	Food does not pass into the respiratory tract.
2	Food passes into the respiratory tract, staying above the vocal cords and it can be coughed out of the respiratory tract.
3	Food passes into the respiratory tract, staying above the vocal cords but it cannot leave the respiratory tract.
4	Food passes into the respiratory tract, touches the vocal cords, and is pushed out of the respiratory tract.
5	Food passes into the respiratory tract, touches the vocal cords but cannot be pushed out of the respiratory tract.
6	Food passes into the respiratory tract, it passes beneath the vocal cords and cannot be pushed out of the larynx or respiratory tract.
7	Food passes into the respiratory tract, it passes beneath the vocal cords and cannot be pushed out of the trachea despite the efforts.
8	Food passes into the respiratory tract, it passes beneath the vocal cords, but a patient is too weak to cough it up.

Table 3.
Penetration-aspiration scale (PAS) developed according to Rosenbek criteria.

	Main findings	Grade	Potential clinical consequences
Saliva	Penetration/aspiration	Grade 6	No oral eating, only tube feeding
Pudding	Penetration or aspiration without or insufficient protective reflex	Grade 5	Tube feeding
Pudding	Penetration/aspiration with sufficient protective reflex	Grade 4	Tube feeding with small portions of pudding for oral eating during rehabilitation procedures
Liquids	Penetration or aspiration without or insufficient protective reflex	Grade 4	Tube feeding with small portions of pudding for oral eating during rehabilitation procedures
Liquids	Penetration/aspiration with sufficient protective reflex	Grade 3	Oral eating of pureed food
Solid food	Penetration/aspiration with food residues in the pyriform sinuses	Grade 2	Oral eating of pudding or liquids
Solid food	No penetration or aspiration, mild residues of food in the sinuses	Grade 1	Oral eating of semi-solid food or liquids

Table 4.
Fiberoptic endoscopic dysphagia severity scale (FEDSS).

Overall estimate	0 = no dysphagia	1 = mild dysphagia	2 = moderate dysphagia		3 = severe dysphagia		4 = very severe dysphagia	
Penetration-Aspiration Scale (PAS)	1	2	3	4	5	6	7	8
Endoscopic Dysphagia Severity (FEDS)	1	2	3		4	5	6	

Table 5.
Overall estimate of dysphagia severity.

6. Dysphagia complications

Dysphagia and protein-energy malnutrition, being predictors of bad functional recovery, are always associated with a high risk of medical complications. Weaning from mechanical ventilation of such patients is difficult. They have a high risk of purulent-septic complications. At the same time, a risk of sudden death increases [31].

Dysphagia complications are malnutrition, dehydration, weight loss, and respiratory tract obstruction. Aspiration pneumonia is one of the most important complications of dysphagia [32].

When a stroke is complicated with dysphagia, malnutrition occurs 3 times more often than without it. The cases of protein-energy malnutrition in patients suffering a stroke vary from 7% to 15% at acute stage and from 22% to 35% after 2 weeks from the disease onset. Starvation or malnutrition associated with dysphagia activates catabolic processes. Among stroke patients requiring long rehabilitation period, malnutrition can amount to 50%. Malnutrition syndrome is risk factor of pneumonia. It increases sensitivity to oropharyngeal flora, leads to immunity suppression, reduces coughing strength, and affects wakefulness. All these factors complicate rehabilitation procedures [33].

Aspiration is also one of the most dangerous complications of dysphagia. It leads to the respiratory tract obstruction, hypoxia, and aspiration pneumonia [34].

7. Treatment and rehabilitation of dysphagia patients

Neurogenic dysphagia treatment is provided in complex with primary disease treatment. Stroke patients need follow-up and treatment and rehabilitation procedures by multidisciplinary team, including nutritional support, exercises and physiotherapy, logopedic correction, pain control treatment, and psychological correction [9, 15, 35].

Screening test shall always be conducted prior to patient feeding. Patient shall take oral medicines only in the presence or with assistance of medical staff. After taking medicines, a patient shall drink small portions of water. For this purpose, a patient shall be in a semi-sitting position or shall lie on a side with elevated chin; a risk of aspiration is lower in these positions. If even a mild swallowing disorder at pharyngeal phase is observed, it is required to act vice versa: to lower the chin. In this position, the tongue root is pushed backwards, and the epiglottis protective position is improved. This movement compensates for delayed initiation of pharyngeal swallow, as it narrows laryngeal inlet and prevents the bolus passing into the respiratory tract [36].

With nasogastric tube feeding, it is necessary to remember that long-period nasogastric feeding may cause such complications as nasopharyngitis, esophagitis, esophageal stricture, and nasopharynx edema. When dysphagia progression occurs or no swallowing function dynamics have been observed for a long period, a gastrostomy tube is used [37].

Dysphagia patient management, depending on the level of consciousness, reasoned contact, use of a tracheostomy tube, and other factors, shall include the following actions related to examination: [38].

- Medical history taking;
- Swallowing screening test within 3 hours from the moment of admission;
- Examination of the oral cavity, teeth and gums, palpation of the regional lymph nodes;

- Examination of the mouth and pharyngeal mucosa sensitivity;
- Examination of patient's speech apparatus;
- Pharyngeal reflex assessment;
- Testing of the reaction to the tracheostomy tube (when required);
- Testing of the reaction to sanitation of the area above the tracheal cuff (when required);
- Examination of saliva and sputum accumulated in the area above the cuff (when required).

Dysphagia rehabilitation procedures shall include: [39].

- Correct selection of patient feeding pattern;
- Calculation of the caloric value of products with modified consistency and selection of nutritional formulas ensuring nutritional support;
- Selection of food consistency, methods of oral cavity mucosa sensitivity stimulation, swallowing process stimulation and disinhibition, recovery of breath, speech;
- Logopedic exercises therapy aimed at correct positioning, stimulation of active swallowing, normal breathing, recovery and enhancement of functional activity of the muscles involved in the process of swallowing and eating: the muscles of mastication, expression, the tongue muscles;
- Physiotherapeutic treatment methods; in such case, the procedure of choice for neurogenic dysphagia is the larynx electrical stimulation of swallowing reflex;
- Acupuncture;
- Surgical correction (if medically required) aimed at creation of alternative ways for patient feeding;
- Psychological correction;
- Hygienic care of the oral cavity;
- Lifestyle correction aimed at correction or creation of the conditions facilitating independent eating process for patients when the function is diminished or impaired;
- Teaching relatives on feeding skills and complication prevention.

In order to facilitate the impaired process, various methods of swallowing training and retraining are developed. These methods include strengthening exercises, biofeedback stimulation, temperature and taste stimulation [29, 40].

The following rehabilitation methods are used for neurogenic dysphagia patient rehabilitation:

1. Preparatory. Preparation of the oral cavity for swallowing (cleaning and moisturizing with a sponge), removal and installation of removable dentures.
2. "Swallowing enhancement" method. After patient examination, food consistency, which is optimal as for the current moment, is selected. Subsequently, food of various consistency is given, and the volume of food for single administration is increased gradually. At the same time, the required swallow volume, amount of food for single administration, and feeding temperature range are determined. Taste sensation is recovered throughout the rehabilitation period.
3. Replacement therapy method. Nasogastric tube is installed (percutaneous endoscopic gastrostomy is further applied when required). In several cases, parenteral feeding is used.
4. Postural method, which involves the selection of a proper posture required for eating.
5. Training method, which consists of training exercises for strengthening the muscles involved in swallowing process, recovery of swallowing control function.

Complex approach and consistency of dysphagia patients rehabilitation of stroke patients is well-established. Rehabilitation shall be conducted by the members of the multidisciplinary team (MDT) trained on the methods of dysphagia-specific assistance rendering. It is quite important that speech-language pathologists carry out the main works on rehabilitation of neurogenic dysphagia patients. But other members of MDT shall assist speech-language pathologists: physician involved in therapeutic exercises, physiotherapy doctor, as well as patient's relatives.

Physiotherapy tasks: [41, 42].

- Development of adequate afferentation flow by low-frequency electrophonopedic articulation simulation;
- Speech and swallowing management program support;
- Support of non-functioning muscles tonus to prevent their atrophy;
- Prevention of degradation process in the cricoarytenoid joint capsule;
- Recovery and support of CNS regulatory function.

Physiotherapy aimed at electrical stimulation of the larynx and tongue root shall be performed during most of the acute stroke period, when it is medically substantiated.

Approximate current parameters for electrical stimulation:

- Pulse shape: triangular, with a very slow rise;
- Pulse time: 200 ms;
- Pause time: 1,000–7,000 ms (depending on patient's readiness);

- Current intensity: 2.5 mA;
- Time of procedure execution: 30 min;
- Frequency of execution: every day No. 10–15.

The effectiveness of rehabilitation techniques in the treatment of patients after stroke has been shown in a number of studies [4, 10, 18, 29, 37–39]. Various methods of swallowing as part of complex therapy for dysphagia in stroke have shown high efficiency. The best results of swallowing recovery are shown when using integrated approach, include specialized nutritional mixtures with different densities. Recovery was better in patients with pseudobulbar disorders [16, 35]. Involvement of patient's relatives and patient motivation plays a significant role in recovery [4, 9].

8. Dysphagia patients feeding

To perform oral feeding, it is necessary to awaken a patient and seat him/her up before feeding. Make sure a patient stays in a sitting position for 20–30 minutes after the end of oral feeding. First of all, it is necessary to ask patient if he/she wants to take breakfast, lunch and dinner among his/her family members or prefers to eat alone. Anyway, it is necessary to arrange the meal in a comfortable, quiet, and friendly atmosphere, and to put away all unwanted noise sources so that the patient can focus on eating. A patient with difficulty swallowing needs sufficient time for eating. Do not hurry a patient. It is important that a patient feels safe and enjoys the meal while eating.

It is necessary to provide proper positioning of a patient. Correct posture is important to prevent food aspiration while swallowing. When possible, a patient shall sit in an armchair while eating.

When a patient is fed sitting in the armchair, prepare pillows to keep the patient's position, comfortable table and non-slipping carpet before feeding.

Patient shall sit in so that the feet rest on flat surface or on the floor, the body is in vertical positions, and hands are free. If a patient is able to sit on a chair while eating, he/she can also incline forward and lean upon the table. Body inclined forward will prevent the head throwing back. Patient's head shall be on the middle line, not inclined rather than thrown back. The neck shall be slightly (not too much) bent forward to prevent aspiration.

When a patient is not able to keep his/her head position by own efforts, it is necessary to support his/her neck and shoulders from the back to prevent the head throwing back and to help a patient to control his/her tongue position. If, however, the patient's head is inclined too far forward, it is necessary to support his/her chin with the assistant's hand from below or to use special locking collar for the head support.

To prevent aspiration in the process of swallowing, the "chin-to-chest" posture will help; and for patients with unilateral weakness of the tongue muscles, slight turning of the head towards the impaired side while swallowing will be helpful.

When a patient is fed in the bed (if it is impossible to sit him/her in a bedside chair), the patient shall be kept in a comfortable semi-vertical position. For this purpose, raise a patient slightly to the bedhead, supporting him/her with pillows so that the body rests along the middle line. The head and neck shall be inclined forward slightly. The patient's knees shall be bent slightly with a cushion/pillow put underneath.

It is necessary to teach a patient to take food and to lift it to his/her mouth with a hand or both hands. When a patient is not able to suck in liquids, teach him/her to drink from a spoon.

Patient shall be advised to take just a small amount of food or liquid at a time. Teach a patient to lift food or liquid to the middle of his/her mouth, not to a side, and to take food in the mouth using lips, not teeth.

It is quite important to attract patient's attention to the fact that his/her oral cavity shall be absolutely empty after each spoon or piece of food, in order to prevent food accumulation at the side with weak tongue or cheek muscles. Patient shall remove food residuals with a finger after each swallow.

When required, help a patient to clean his/her oral cavity: mucus and saliva accumulated in the mouth shall be removed with wet towel on a regular basis. Remember that the patient's teeth and dentures shall be cleaned minimum twice per day to maintain the oral cavity hygiene.

Do not give a patient drinks together with solid food. In order to reduce the risk of aspiration, drinks shall be given prior to or immediately after eating.

When a patient meets problems with food swallowing, ask him/her to cough up.

Examine the patient's oral cavity after eating. As far as a risk of aspiration still exists for a certain period of time after eating, a patient shall stay in vertical position for 30–40 minutes after the meal.

Do not feed a patient if there are any doubts concerning his/her ability to swallow. In such cases, tube feeding is required.

9. Conclusion

We now know much more about neurogenic dysphagia than we did before. The questions of pathogenesis, clinical picture, diagnostics are well studied. The described approaches in the diagnosis and treatment of neurogenic dysphagia play an important role in clinical practice and are necessary for quality medical care for these patients. Although to date, the level of their evidence remains in the category of cohort studies and expert opinion. This means that we have a lot of interesting work ahead of us and, I hope, important discoveries.

Conflict of interest

No conflict of interest.

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