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GUIDELINE

Consensus on the Screening, Assessment, and Nutritional Management of Dysphagia

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Abstract

Dysphagia, characterized by impaired swallowing function, presents a substantial healthcare burden globally, affecting various populations and conditions. The present article aims to present a comprehensive clinical consensus on dysphagia diagnosis, assessment, and management, derived from an expert group comprising diverse healthcare professionals in India. Through systematic literature reviews and consensus development methodologies adhering to international standards, evidence-based recommendations were formulated to address key aspects of dysphagia care. Recommendations encompass screening protocols, diagnostic modalities, nutritional assessments, and therapeutic interventions, including exercises and feeding strategies. The consensus underscores the importance of early detection and tailored interventions, particularly in high-risk populations such as stroke patients. By integrating contemporary evidence and expert insights, this consensus offers a structured framework to enhance dysphagia care standards, with the overarching goal of improving patient outcomes and reducing associated morbidity and mortality. This comprehensive guideline is a valuable resource for healthcare practitioners involved in managing dysphagia, facilitating optimized patient care and improved quality of life.

Keywords: Dysphagia; Texture-modified; Commercial thickeners; Aspiration; Swallowing

1 Introduction

The International Classification of Functioning, Disability, and Health has defined dysphagia as "the difficulty in transferring food from the mouth to the stomach."

1.1 Disease Burden and Epidemiology

A systematic review and meta-analysis including 27 articles reported that the global prevalence was 43.8%[1]. The global prevalence of dysphagia ranges between 2% to 20%[2]. As per global statistics, the prevalence of oropharyngeal dysphagia is between 2.3 and 16%. Its prevalence is high with predisposing conditions, such as aging and stroke, with a prevalence of 26.19% in the elderly[3], 8.1-80% in stroke patients[4], and 21.9-69.5% in patients taking antipsychotic drugs[5].

Currently, there is limited data regarding the prevalence of dysphagia etiologies in India. In a study conducted in North India, the distribution of dysphagia cases among males and females was 63.6% and 36.4%, respectively. Amongst the important causes of dysphagia, malignancy was identified as an important cause of dysphagia, the total percentage being 35%[6]. A study from central India has shown that the maximum cases of dysphagia in that study were due to carcinoma oesophagus (47%)[7]. Krishnamurthy R et al. have reported in their systematic review and meta-analysis that the pooled prevalence of dysphagia and pneumonia for patients with stroke in India was reported to be 47.71% and 20.43%, respectively[8].

Dysphagia is commonly related to several diseases, such as cerebrovascular accidents, amyotrophic lateral sclerosis, Parkinson's disease, myasthenia gravis, and tardive dyskinesia. However, the elderly are at increased susceptibility to the development of dysphagia due to illnesses that affect the swallowing mechanism. Compared to community-dwelling elderly, the prevalence of dysphagia in the elderly is even higher in those living in assisted living facilities and nursing homes[9].

1.2 Causes of dysphagia in India

Dysphagia is classified into four categories depending on the site of swallowing impairment: oropharyngeal, oesophageal, esophagogastric, and paraesophageal. These four types of dysphagia occur in four different continuous anatomic regions. Table 1 enumerates the causes of dysphagia and the associated disorders.

- **Oropharyngeal dysphagia:** It is caused when there is difficulty in emptying the food bolus from the oral cavity to the cervical oesophagus. Symptoms of this condition may include the sensation and occurrence of food sticking in the oral cavity or neck region and symptoms of pulmonary aspiration. Neuromuscular conditions account for almost 75 to 85% of causes leading to this type of dysphagia. Impairment of the upper oesophageal sphincter may be the most common cause of oropharyngeal dysphagia [10].
- **Oesophageal dysphagia:** This type of dysphagia occurs when there is difficulty with the movement of solid or fluid through the oesophagus, especially in the area between the upper and lower oesophageal sphincter. Abnormal motility or physical impairment to passage could lead to this condition. The symptoms depend on the etiology of the oesophageal disturbance. In the case of motility disorders, symptoms include spasms and chest pain. In contrast, in the case of physical obstruction, the swallowing difficulty is greater and occurs earlier for solids than fluids [10].

Various grades of dysphagia have been provided:

- Normally eating
- Swallows meal with liquid
- Swallows semisolids
- Liquid alone
- Saliva alone
- Unable to swallow saliva

1.3 Challenges and complications with dysphagia

Dysphagic symptoms are driven by abnormalities in the rate of food consumption, mastication, bolus transfer, respiration, and swallow initiation [11]. The symptoms are characterized by difficulties in the passage of food or liquid from the mouth through the pharynx, oesophagus, and stomach.

Dysphagia has a negative impact on the quality of life and reduces work productivity. It is the 10th leading cause of ambulatory care visits in the US among gastrointestinal symptoms, with more than 6 lakh annual visits [12,13].

Dysphagia is associated with choking, abnormalities in bolus transfer, aspiration pneumonia, respiratory insufficiency, abnormalities in bolus transfer, reduced quality of life due to reliance on alternative feeds for years, intake disorders of water and nutrition, pulmonary contamination by swallowed material, malnutrition, neurogenic dysphagia, severe obstruction, aspiration of gastric contents, cardiac arrest, and regurgitation.

Dysphagia significantly increases the risk of malnutrition, aspiration pneumonia, and choking, varying in severity across individuals [14]. Choking incidents could be distinguished into five types depending on the results of clinical assessments: bradykinetic, dyskinetic, fast eating syndrome, paralytic, and medical [15]. Dysphagia is one of the most important risk factors in the development of pneumonia, and the incidence of pneumonia was higher among patients with dysphagia compared with those without dysphagia. Post-stroke dysphagia frequently results in poor nutritional status, aspiration pneumonia leading to prolonged hospital stay, poor functional capacity, poor prognosis, and increased mortality [16].

Dysphagia can be associated with considerable morbidity and mortality. When untreated, dysphagia may cause dehydration, malnutrition, respiratory infections, and death. Patients with symptoms of dysphagia are more prone to the risk of complications of dysphagia, including aspiration pneumonia. Patients with dysphagia are subject to substantial social and psychological burdens related to the associated symptoms such as swallowing, anxiety during meals, or avoidance of eating with others [6]. Community-acquired pneumonia is a significant cause of morbidity and mortality in the elderly. and the leading cause of fatality among residents of nursing homes. One of the primary factors causing pneumonia in the elderly is oropharyngeal aspiration. It has also been shown that the occurrence of cerebrovascular and degenerative neurologic diseases increases with aging, which is in turn associated with dysphagia and impaired cough reflex with raised chances of oropharyngeal aspirations [17].

1.4 Risk factors causing Dysphagia

Swallowing function is affected by certain issues, such as loss of muscle mass, changes in the cervical spine, impaired dental status, and decreased saliva production. In the case of oropharyngeal dysphagia, aging, neurological diseases such as Parkinson's dementia, multiple sclerosis, stroke, head and neck cancer, neck surgery, traumatic brain injury, and chronic obstructive pulmonary disease act as causative factors [1].

In elderly patients, identifying the risk factor becomes the driving factor for identifying, assessing, and controlling these risks. Age; comorbid conditions such as stroke, Parkinson's disease, multiple sclerosis, head and neck cancer, and skeletal muscle; surgical and other therapeutic factors are common risk factors causing dysphagia in the elderly [18].

Table 1. Causes of Dysphagia

Categorized by Type and Etiology		
Oropharyngeal dysphagia [Difficulty emptying material from the oropharynx into the esophagus]	Neurological conditions	Stroke Parkinson's disease Multiple sclerosis Motor neuron disorders Giant cell arteritis
	Muscular disorders affecting skeletal muscles	Myasthenia gravis Dermatomyositis Muscular dystrophy Cricopharyngeal In-coordination
	Cancer and related treatment	
Oesophageal dysphagia	Oesophageal motility disorders	Achalasia Diffuse oesophageal spasm Systemic sclerosis Eosinophilic esophagitis
	Mechanical obstruction a) In the lumen (foreign body or food bolus) b) In the wall (tumours-benign or malignant; from different layers of the esophagus; commonly the mucosa and muscle, strictures) c) Outside the wall (para-esophageal dysphagia)	Peptic stricture Oesophageal cancer Oesophageal rings Oesophageal webs Radiation stricture Caustic ingestion Adenocarcinoma
Structural disorders		Premalignant condition Extrinsic features Cervical osteophytes
Head, neck or esophageal surgery causing deformity		
Neurologic		Cardiovascular abnormalities Other causes of paralysis

1.5 Rationale and objective of the consensus

The aims of developing the clinical consensus are: (1) to establish how dysphagia should be diagnosed and assessed, (2) to suggest how to manage dysphagia caused by different etiologies, including oropharyngeal, oesophageal, and structural disorders, and (3) to provide a systematic approach to manage nutrition in dysphagia patients.

2 Methods

The consensus was developed by an expert group belonging to the following disciplines: speech-language pathologists, clinical dietitians & nutritionists, deglutologists, gastroenterologists, otolaryngologists, gastrointestinal surgeons, head and neck surgeons, and academicians from India. All working group members had declared their individual conflicts of interest according to the rules of the International Committee of Medical Journal Editors (ICMJE).

The methodology was based on the methodology adopted by the ESPEN guidelines [19]. The topics to be covered in the consensus were decided after several rounds of discussion and alterations. The literature search was initiated as per the diagnosis, assessment, and management of dysphagia; however, the scope was broadened after a meeting "when it was decided to expand the scope of the consensus to include dysphagia caused by different etiologies, including oropharyngeal dysphagia, oesophageal dysphagia, and that due to structural disorders. The literature search was conducted through several clinical questions in a PICO format when relevant. The working process was supervised and monitored by the IAPEN representative for methodological quality. The draft and the literature were made accessible to all the members through a shared Google Drive.

The draft was sent to the guideline group via email in the first Delphi round in December 2023. We received a strong consensus (agreement of >90%) in 80.0% of recommendations and a consensus (agreement of 80–90%) in 20.0% of recommendations. The recommendations with an agreement lower than 90% were discussed in a virtual meeting on 11th January 2024. After the voting, all the selected recommendations were discussed, modifications were included and reached a consensus greater than 90%. There were no recommendations with less than 80% consensus.

Before starting with the classical literature search, the relevant published guidelines were explored and identified. Following the first review, the main bibliographic databases, including PubMed and the Cochrane Library, were searched for systematic reviews and meta-analyses that answered the clinical questions. In their absence, other indirect systematic reviews and meta-analyses were looked up, and in the absence of these, comparative studies were explored, whether randomized or not. An updated literature search was also conducted to retrieve further comparative studies. The screening was performed by reading the abstract, followed by the

entire article when necessary. A literature search was conducted for the last 10 years until January 2024, although the working group was allowed to consult and include highly relevant older articles in the study.

The classification of the literature according to evidence levels and the grades and forms of recommendations were performed following the Scottish Intercollegiate Guidelines Network (SIGN) grading system, updated in 2019 [20]. Tables 2 and 3 depict the grading system adopted in the development of the consensus.

Table 2. Level of evidence

Evidence level	Description
1++	High-quality meta-analyses, systematic reviews of RCTs, or RCTs with a very low risk of bias
1+	Well-conducted meta-analyses, systematic reviews, or RCTs with a low risk of bias
1-	Meta-analyses, systematic reviews, or RCTs with a low risk of bias
2++	High-quality systematic reviews of case-control or cohort studies. High-quality case-control or cohort studies with a very low risk of confounding or bias and a high probability that the relationship is casual.
2+	Well-conducted case-control or cohort studies with a low risk of confounding or bias and a moderate probability that the relationship is causal
2-	Case-control or cohort studies with a high risk of confounding or bias and a significant risk that the relationship is not causal.
3	Non-analytic studies, e.g., case reports, case series
4	Expert opinion

Table 3. Grading of recommendations

Evidence grade	Description
A	At least one meta-analysis, systematic review, or RCT related as 1++, and directly applicable to the target population: OR A body of evidence consisting principally of studies rated as 1+, directly applicable to the target population, and demonstrating overall consistency of results.
B	A body of evidence, including studies rated as 2++, directly applicable to the target population, OR A body of evidence including studies rated as 2+, directly applicable to the target population, and demonstrating overall consistency of results, OR Extrapolated evidence from studies rated as 1++ or 1+
C	Evidence level 3 or 4; OR Extrapolated evidence from studies rated as 2++ or 2+
GPP	Good practice points/expert consensus: Recommendations based on a consensus of expert opinion based on clinical experience.

3 Results

After the literature search, evaluation, and grading of the evidence, the guideline development group drafted a total of 12 recommendations.

3.1 The approach to dysphagia assessment

Dysphagia detection is an important contributor to earlier management, prevention of comorbidities, and improving the quality of life. It is also important to assess the severity and the progression of dysphagia. Patients who are asymptomatic but at risk of dysphagia must be screened to detect early symptoms or swallowing dysfunction and identify those that need more comprehensive and definitive swallowing assessment for appropriate management [21].

Patients with dysphagia may present with multiple complaints, but the most common symptoms include coughing, choking, or the abnormal sensation of food sticking in the back of the throat or upper chest while attempting to swallow. The approach to evaluating dysphagia follows the steps given in Figure 1.

3.2 Clinical History

A focused history and an examination of the site of swallowing difficulty will help in distinguishing dysphagia from alternate diagnoses that are not true dysphagia. A careful history also distinguishes oesophageal from oropharyngeal dysphagia, whether the dysphagia is experienced when swallowing solids and liquids or only solids, whether it is progressive, and whether there are other associated symptoms such as pain on swallowing or regurgitation [22]. **Box 1** shows a few important questions that must be included in the history taking [22].

Questions distinguishing oropharyngeal dysphagia from oesophageal dysphagia.

1. Is there delay in initiating the swallow?
2. Is there deglutitive postnasal regurgitation?
3. Is there deglutitive coughing?
4. Is repetitive swallowing needed to achieve satisfactory clearance?

 # An answer 'Yes' to any of the questions given above is suggestive of oropharyngeal dysphagia.

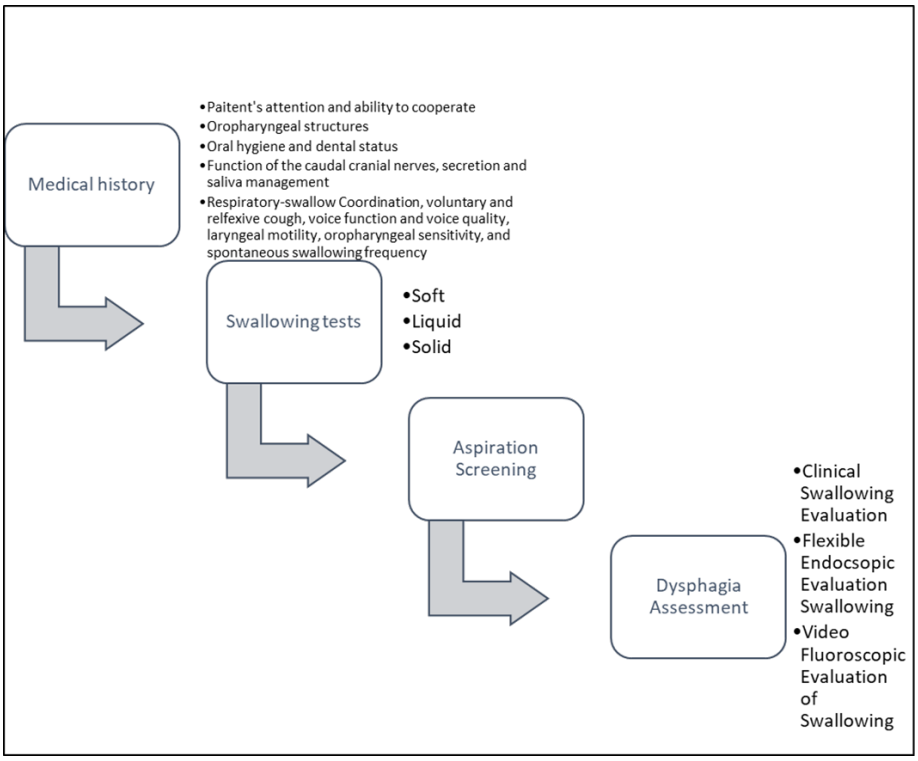

Fig 1. Approach to Dysphagia Diagnosis

3.3 Aspiration Screening

Aspiration screening is important to rapidly and reliably identify patients at risk of aspiration to initiate prophylactic measures and further assessment. It is important to ensure that the screening procedures are designed in a way that they can be carried out following appropriate training by different healthcare workers, even if they have not received dysphagia-specific training. It is also worth mentioning that a large proportion of the test protocols that have been published are assessed in stroke patients. However, some are also evaluated in mixed cohorts of dysphagia patients. In the absence of evidence evaluating the optimal test in all dysphagia patients, there are no standardized test approaches suggested so far [23,24].

The screening methods are divided into three categories: water swallowing tests, multi-consistency tests, and swallow provocation tests [25]. Pulse oximetry for aspiration detection is considered to be of low sensitivity despite its use in several test protocols, as studies have shown that a reduction in oxygen saturation of more than 3% was neither predictive nor sensitive for aspiration [26].

The water swallowing test usually assesses whether the patient can drink a defined amount of water without clinical signs of aspiration. The results of the water swallowing test are always binary; either the patient has clinical signs of aspiration requiring nil per os and results in a more refined diagnostics, or the test is inconspicuous, following which oral intake is possible. The Water Swallowing test is considered when assessment of swallowing safety is important and further assessment of swallowing function can be conducted rapidly.

Besides this, multi-consistency tests like the Gugging Swallowing Screen or the Volume Viscosity Test assess whether other fluids can be swallowed. These tests are intended for a stepwise classification of swallowing impairment and the addition of dietary recommendations to their risk assessments [25]. In the case of patients who are non-cooperative and cannot receive an oral bolus, the Swallow Provocation Test is used to examine the involuntary swallowing reflex. It hence focuses on the pharyngeal phase of deglutition [25]. The multi-consistency test is recommended if, along with the safety of swallowing, swallowing efficiency also needs to be evaluated, and a more differentiated swallowing assessment for determining the optimal oral diet is not available within a reasonable time [27].

In case of negative screening results, further dysphagia assessment is recommended in stroke patients if the patient presents with other risks of dysphagia, such as a severe neurological deficit, severe dysarthria or aphasia, or severe facial palsy. This additional assessment is also recommended in patients with a high risk of silent aspiration, such as Parkinson's disease [28].

Aspiration screening in patients with neurogenic dysphagia has been significant, especially in patients with acute stroke. Prospective observational studies have shown that evaluation of aspirations screening was related to a reduction of infectious complications[29]. In another prospective, multicentre observational study, it was seen that a formal aspiration screening showed significantly reduced pneumonia and mortality rates[30]. A pre-post comparison revealed that implementing a nurse-based aspiration screening led to a 50% reduction in pneumonia rates in stroke survivors[31]. A large retrospective registry involving over 60,000 patients also showed that performing an aspirations screening after stroke was reported to be time critical. The risk of developing pneumonia increased from just over 3% with prompt clinical examination to almost 4.5% when testing was conducted later than 24 hours[32]. Similar associations between delayed performance of aspiration screening and increased risk of pneumonia were also seen in other studies[33].

3.4 Dysphagia Assessment

Clinical Swallowing Examination (CSE) should be carried out by trained speech and language therapists (SLTs). CSE provides an accurate evaluation of the severity and phenomenological pattern of the swallowing impairment to allow for further diagnostic assessments, dietary recommendations, and treatment planning. Even though it is widely used in everyday clinical practice, its validity is restricted. It was reported in a cohort of acute stroke patients that CSE has a comparatively good sensitivity of 86% for the determination of aspiration risk. Still, since it has a specificity of just 30%, no reliable conclusions can be drawn about the presence of a disturbance in the swallowing act. A comparative study between CSE and VFSS showed that the use of CSE could only assess laryngeal elevation while failing to assess other parameters of swallowing physiology, such as oral transit, swallowing reflex latency, and total duration of swallowing[34].

During the initial two weeks after stroke, a significant improvement of dysphagia is seen in a high number of patients, especially those with supratentorial lesions[35–38]. However, in the case of stroke recurrence, a worsening of swallowing function could be seen[39]. Hence, a regular dysphagia assessment is necessary in acute stroke patients. In a randomized controlled study, it was seen that early behavioral swallowing intervention was linked to a considerable decrease in infectious complications and an increase in the proportion of patients regaining swallowing function[40].

Flexible Endoscopic Evaluation Swallowing : In many parts of the world and several guidelines, Flexible Endoscopic Evaluation Swallowing (FEES) has been established as the diagnostic standard for the assessment of swallowing. FEES provides comprehensive information about the pharyngeal phase of swallowing and enables the identification of impairment within the oral and oesophageal phases. It aims to identify pathological movement patterns, assess the effectiveness and safety of swallowing, assess suitable food consistencies and feeding strategies, and guide the use of therapeutic maneuvers for individual patients. The standard FEES protocol consisted of the following steps, including anatomical-physiological examination, swallowing without and with defined test boli, and an evaluation of the efficacy of the therapeutic methods[25]. As per ASHA clinical guidance, FEES may be recommended irrespective of treatment setting, used without concerns of radiation exposure, and can be used within the frames of diagnostic and therapeutic contexts[41]. The scales available for evaluating the salient endoscopic findings are the penetration aspiration scale, according to Rosenbeck[42], the Yale Residue scale[43], the Secretion Severity Scale[44], and the Scale for Quantification of Premature Spillage[45]. Other than the standard FEES protocol, several other specific examination protocols have been developed and validated for different clinical conditions: FEES Tensilon-Test and Fatiguable Swallowing Test for the detection and assessment of myasthenia dysphagia, FEES-L-Dopa Test for assessment of L-Dopa-sensitive dysphagia in patients with Parkinson's syndrome, FEDSS for the classification and management of stroke-related dysphagia, and decannulating algorithm to examine the feasibility of decannulation in tracheotomized intensive care patients[46].

Following the FEES test, the patients should be referred for consultation by an otolaryngologist or phoniatrician. In a study, it was shown that FEES was performed safely and well tolerated by all the patients with dysphagia, especially stroke, Parkinson's disease, critical illness polyneuropathy, motor neuron disease, dementia, myasthenia gravis, and myopathies. It also led to a significant impact on dysphagia management[47]. Considering FEES results, over 40% of the patients were able to achieve a more liberal oral diet, while more than 10% needed a more careful nutritional approach. Among the tracheotomized patients, decannulation was possible in over 25% of the cases based on FEES results. The results of a retrospective study showed that following the implementation of bedside FEES service in a stroke unit, pneumonia rates were significantly reduced from 12% to 7%. Besides this, dependent on FEES results, patients had increased chances of receiving a regular diet at discharge, while the duration of non-oral nutrition and the duration of hospital stay increased[48].

Video Fluoroscopic Evaluation of Swallowing: The Video Fluoroscopic Swallowing Study (VFSS) or the modern digital method (Digital Fluoroscopic Swallowing Study, DFSS) is a radiological examination of the entire swallowing act, including oral, pharyngeal, and oesophageal stages. VFSS distinguishes between dysphagia symptoms such as aspiration, residues, and underlying pathomechanisms[25]. It also offers quantitative measures such as the oral onset time, the oral transit time, the pharyngeal transit time, the

anterior-superior movement of the hyoid, the duration and size of the velopharyngeal closure and the duration and width of the opening of the upper oesophagus sphincter. Studies have shown that the specific VFSS parameters are linked to penetration and aspiration[49,50]. VFSS results also serve as indicators for the recovery of swallowing function after stroke[51] or for patient response to dysphagia swallowing interventions[52]. Several scores available that can characterize dysphagia severity have also been devised, including the Modified Barium Swallow Study Impairment Profiles, the Dynamic Imaging Grade of Swallowing Toxicity (DIGEST), and the Parkinson Disease VFSS Scale (PDVFS) scale. The MBSImP has been used to characterize dysphagia in COPD patients[53], the DIGEST score has been used in patients with oculopharyngeal muscular dystrophy and amyotrophic lateral sclerosis[54,55], and the PDVFS is a disease-specific score to detect the risk of aspiration pneumonia[56]. In stroke patients with dysphagia, VFSS may bring about a safe change in the route of feeding from artificial enteral nutrition through an NG tube to an oral diet[57]. VFSS enables the detection and comprehensive description of the complex pathomechanisms of swallowing disorders affecting laryngopharyngeal and -oesophageal interactions. It also offers the advantage of capturing the entire swallowing act, including the oral phase, pharyngeal constriction, epiglottic inversion, hyolaryngeal elevation, upper oesophageal sphincter function and the oesophageal phase in high resolution[25].

Manometry: Manometry, especially high-resolution manometry (HRM), allows the endoluminal pressure conditions in the pharynx and esophagus to be measured during the swallowing act. It is of significant importance to prove relaxation disorders of the UES and motility disorders of the esophagus (achalasia, diffuse oesophagospasm)[58]. The parameters that are assessed during manometry are resting pressure, the opening of the upper and lower oesophageal sphincters as well as peristalsis, pressure, and amplitudes of the tubular oesophagus[59]. HRM has been used for the assessment of oesophageal motility in patients with neurological diseases such as Parkinson syndromes[60], inflammatory myopathies[61], and Morbus Huntington[62]. HRM is useful in neurology, especially in patients with opening disorders of the UES as a result of myopathies or strategic brainstem infarctions[63]. Pharyngeal HRM is used in many neurological diseases, such as stroke[64], Parkinson's disease[65], and inflammatory and genetically determined myopathies[66], to describe the pattern of swallowing impairment.

Even though manometry is a good choice to complement FEES and VFSS, pharyngeal manometry is still not integral to routine dysphagia diagnostics.

The Table 4 provides instrument-wise guidance for various indications[25].

Table 4. Instrument-wise guidelines for various indications

Methods of instrumental dysphagia evaluation	Indications
Endoscopy	The gold standard is especially suitable for the evaluation of saliva accumulation and for sensory testing, the preferred method in stroke units and neurological intensive care units to assess the velopharyngeal closure mechanism.
Videofluoroscopy	Gold standard; assessment of all swallowing phases; especially suitable for assessing intra-deglutition aspiration, hyolaryngeal elevation, epiglottic tilt, contact of the tongue-base to the back of the pharyngeal wall, and impaired opening of the upper oesophageal sphincter.
Manometry	Recording of timing and amplitude of the pharyngeal and oesophageal contraction and impaired opening of the upper and lower oesophageal sphincter, especially before possible cricopharyngeal myotomy and oesophageal motility disorders.
Electromyography	Biofeedback

3.5 Assessment of malnutrition

Assessing malnutrition in individuals with dysphagia (swallowing difficulties) involves a multi-faceted approach that considers both the impact of swallowing problems on nutritional intake and the overall nutritional status of the individual.

3.5.1 *Nutritional Screening:*

- **Mini nutritional assessment (MNA) :** A widely used screening tool for malnutrition, the MNA assesses various aspects of nutritional status and identifies individuals at risk for malnutrition.
- **Eating Assessment Tool (EAT-10) :** This tool specifically assesses dysphagia symptoms and their impact on eating, helping to identify potential swallowing difficulties.
- **Subjective Global Assessment (SGA):** This comprehensive assessment considers medical history, dietary intake, and physical examination to evaluate nutritional status, particularly in cases where weight loss, muscle wasting, or edema are present.

3.5.2 *Anthropometric Measurements:*

- **Body Mass Index (BMI):** BMI is a simple measure of body weight in relation to height, providing a basic

Table 5. Recommendations for Dysphagia Assessment

Recommendations	Evidence Grade
Clinical question 1: Which methods should be used for aspiration screening? How should the risk of aspiration be evaluated?	
Recommendation1(a): A formalized screening for dysphagia should be performed in all patients at risk of dysphagia or with dysphagia.	GPP
Recommendation 1 (b) : The use of specific questionnaires is recommended along with the guided history.	C
Recommendation 1 (c) : Water swallow tests and multi-consistency tests are recommended to be used for aspiration screening. The choice of the optimal should be made based on the patient characteristics and availability for further dysphagia assessments.	C
Recommendation 1 (d) : If the results of initial dysphagia screening are negative, other clinical variables should be considered. If these indicate a high risk of dysphagia, additional assessment tests should be performed.	C
Clinical question 2: Which methods should be used for the assessment of dysphagia?	
Recommendation 2 (a) : The dysphagia assessment should include a clinical swallowing assessment and instrumental diagnostics, particularly in the case of unclear pathomechanism and/or unclear assessment of swallowing safety and swallowing efficacy.	GPP
Recommendation 2 (b): The clinical swallowing examination should be based on validated protocols.	C
Recommendation 2 (c) : Pulse oximetry is not recommended for aspiration screening.	C
Recommendation 2 (d) : FEES and VFSS are complementary methods of instrumental dysphagia assessment; ideally, both should be available.	B
Recommendation 2 (e) : FEES should preferably be used for bedside evaluation in severely motor-impaired, bedridden patients.	C
Recommendation 2 (f) : FEES is preferably recommended for the examination of pharyngeal secretion management and for the assessment of laryngeal and pharyngeal sensitivity.	C
Recommendation 2 (g) : Pathological structural findings determined by FEES should be referred to a specialist, ENT, or phoniatrician.	C
Recommendation 2 (h) : All 4 phases of swallowing, including the oral preparatory, oral transit, pharyngeal and oesophageal phases, can be evaluated during VFSS. In addition, information on the dynamic movement in the gastrointestinal region can also be studied.	C
Recommendation 2 (i) : Manometry is recommended as a complementary diagnostic tool to assess the function of the upper and lower oesophageal sphincter and in suspected oesophageal motility disorders.	C
Recommendation 2 (j) : Clinical and instrumental diagnostics using validated scores should be used for dysphagia management, consistency-specific swallowing safety, and swallowing efficacy.	
Recommendation 2 (k) : Standardized aspiration screening should be performed in neurological patients.	GPP
Recommendation 2 (l) : If neurological patients are admitted to the hospital due to an acute neurological disease or an acute exacerbation of a pre-existing neurological disease, aspiration screening is recommended as soon as possible and should ideally be implemented in the initial diagnostic approach.	GPP
Clinical question 3: How often should the assessment of dysphagia be repeated?	
Recommendation 3 (a): During the initial days of illness, the clinical bedside assessment can be repeated in dysphagic stroke patients on a daily basis. If dysphagia continues, the assessment can be carried out at least twice per week and before discharge, or if dysphagia is fluctuating, as needed. If the clinical assessment is indicative of an improvement or a worsening of swallowing function, an additional instrumental assessment (either FEES or VFSS) can be considered.	GPP
Recommendation 3 (b): If dysphagia persists after discharge, assessment can be done at least once per month for 6 months after stroke appearance.	C

indication of nutritional status.

- **Weight and Height:** Monitoring weight and height changes over time can help track nutritional status and identify potential malnutrition.
- **Mid-upper arm circumference (MUAC):** MUAC measures the circumference of the upper arm and can be used to assess muscle mass and identify wasting, which can be a sign of malnutrition.

3.5.3 *Dietary assessment:*

- **Food Intake Records:** Keeping track of food intake and dietary patterns provides insights into the adequacy and variety of the diet.
- **Dietary Recall:** Assessing past food intake helps understand the individual's typical eating habits and potential nutritional deficiencies.
- **Food Frequency Questionnaire:** This tool helps evaluate the frequency of consumption of different food groups, providing information about dietary patterns.

3.5.4 *Functional Assessment:*

- **Activities of Daily Living (ADL):** Assessing ADL performance helps understand the individual's ability to perform daily tasks, including eating, which can be affected by dysphagia.
- **Eating Assessment:** Observing the individual's eating process, including chewing, swallowing process, allowing clinicians to identify specific swallowing impairments.

3.5.5 *Instrumental Assessment*

- **Videofluoroscopic Swallow Study (VFSS):** This imaging technique provides a detailed view of the swallowing process, allowing clinicians to identify specific swallowing impairments.
- **Fiberoptic Endoscopic Evaluation of Swallowing (FEES):** This procedure involves passing a flexible endoscope through the nose to visualise the pharynx and larynx during swallowing, allowing for assessment of swallowing function.

3.6 Dysphagia management

The therapeutic techniques in dysphagia management are divided into those used as compensatory strategies and exercises and those used as both compensatory strategies and/or exercises [67]. The choice of therapy or treatment approach in a dysphagia patient is dependent on the assessment and evaluation of the patient. The execution of the treatment approach depends on the available evidence from published literature, patient choice, and guideline-based treatments or standard protocols [67].

Table 6.

Recommendations
Early identification of malnutrition in individuals with dysphagia is crucial to prevent further deterioration of nutritional status.
Nutritional support, including dietary modification, nutritional supplements, and tube feeding, may be necessary to address malnutrition in individuals with dysphagia.
Early intervention and appropriate nutritional support can improve the quality of life and clinical outcomes in individuals with dysphagia.

3.7 Malnutrition risk in dysphagia patients

Malnutrition may be present in almost 24% of stroke patients, with studies reporting prevalence between the range of 8 to 48% depending on patient cohort and assessment technique [68]. Malnutrition in stroke patients can lead to a severe impact as it improves functional results and poor quality of life. There is an association between dysphagia and increased dehydration as well as malnutrition in the first 7 days after stroke. This is a reason for an increased duration of hospital stay, greater chances of institutionalization following discharge, increased mortality, and poor functional outcomes. Nutritional deficit is also linked to worsening quality of life in stroke patients. Hence, nutritional assessment must be undertaken in all patients after a stroke [69].

In a systematic review, it was seen that dysphagia is an important complication in chronic patients after stroke. Early identification of this condition through screening tools with adequate diagnostic accuracy (such as volume-viscosity swallow test) is crucial [70]. A study has shown that almost half of the patients with head and neck cancer present with a high risk of malnutrition. Screening can identify head and neck cancer patients who are at risk of malnutrition and eventually require a dietitian for nutritional assessment and support, irrespective of BMI [71].

While no studies support the fact that nutritional support will reduce adverse events or mortality, there is a strong recommendation in favour of nutritional intervention based largely on clinical and expert opinion and that the benefit of the intervention outweighs the risk [69].

3.8 Rehabilitation

Rehabilitation intervention is aimed at enabling patients to swallow safely. Physical rehabilitation relies on strengthening hyoid musculature, including tongue strengthening exercises, the Shaker maneuver, and Chin Tuck Against Resistance to improve swallowing. Tongue-strengthening exercises have shown benefits in dysphagia patients.

Exercises and maneuvers may be considered to be the most widespread treatment approach for patients with neurogenic

dysphagia. Tongue and pharyngeal muscle strengthening exercises are an important treatment method for dysphagia. Strengthening exercises are frequently used for better lingual and pharyngeal strength and improvement in swallowing ability[72]. These exercises intend to raise the diameter of the upper oesophageal sphincter opening and reduce post-deglutitive aspiration and dysphagic symptoms[73].

Restorative techniques are aimed at restoring impaired swallowing functions or promoting residual functions through pre-swallow stimulation (e.g., thermal stimuli), mobilization techniques (e.g., tongue pressing against resistance), and specific motor exercises (e.g., Shaker exercise, Masako maneuver, EMST)[25].

Swallowing exercises are used to treat dysphagia to alter the swallowing physiology and encourage long-term changes. Exercises are classified as compensatory and rehabilitative. Both compensatory and rehabilitative techniques are effortful swallow, supraglottic swallow, super-supraglottic swallow, and the Mendelsohn maneuver. Other exercises to improve swallowing physiology include the Shaker and Masako maneuvers[67]. About 12 randomized controlled trials assessed whether strengthening exercises for the tongue and laryngeal muscles were effective in improving the swallowing function and decreasing the occurrence of aspiration pneumonia. These randomized controlled trials were conducted on patients with brain lesions and head and neck cancer applying rehabilitative techniques, such as head lift exercise, Shaker exercise, Mendelsohn Maneuver, and muscle strengthening exercises of the tongue and larynx[74]. An RCT conducted by Kang and Kim showed that in dysphagia patients with stroke, a significant improvement in neck strength and swallowing function was seen when head lift exercises were performed for 30 minutes, 5 times a week for 6 weeks[75]. The results of two other randomized controlled trials by McCullough et al.[76] and McCullough and Kim[77] revealed that the 2 weeks of the Mendelsohn method training improved hyoid anterior and superior movements and raised UES opening and swallow physiology in 18 patients with stroke and dysphagia. Kotz et al. showed that patients with head and neck cancer patients who performed swallowing exercises (five exercises, including effortful swallowing, super-supraglottic swallowing, tongue hold, tongue retraction, and Mendelsohn maneuver, 10 times per day, and three times per day) experienced better swallowing outcomes than those who did not perform exercises at 3 and 6 months after the treatment[78]. In another study by Lazarus et al., it was seen that tongue-strengthening exercises improved swallowing function in 12 patients with oropharyngeal cancer who underwent radiotherapy compared to those who were given only conventional treatment[73].

In an ideal scenario, based on the physiologic impairment identified through FEES or VFSS, a combination of compensatory and rehabilitative strategies could be adopted for the management of dysphagia symptoms and improve swallowing physiology. In stroke patients with dysphagia, the treatment goal, irrespective of the etiology, is to identify and treat the physiologic impairments, thereby improving outcomes and alleviating symptoms[67].

3.9 Enteral nutrition

In many cases, enteric feeding is the only way to ensure nutritional and hydration intake and to allow medication administration[79]. Guidelines across the world recommend enteral nutrition by NGT as soon as possible following a stroke, with recommendations varying from the first 24 hours,[80] the first 3 days,[81–83] or the first 7 days[84–86]. Hence, enteral nutrition support is indispensable for patients who cannot achieve a full supply of nutritional and energy requirements. An appropriate and timely nutritional intervention plays a crucial role in preventing malnutrition and promoting recovery[87].

However, there is no clear evidence that states which stroke patients will benefit from tube feeding. Stroke patients and those with severe pre-existing malnutrition and with a decreased level of consciousness, severe dysphagia, or severe palsy are considerably impaired in their food intake and are at high risk for malnutrition. These patients are likely to benefit from tube feeding.

The results of the FOOD trial, involving 859 stroke patients, revealed a tendency towards a decrease in mortality in dysphagia stroke patients by 5.8% (p=0.09) in the group with early tube feeding initiated within 7 days after stroke. While the results of the study indicated a potential benefit of early initiation of tube feeding in patients, a prominent limitation of the study is that it only included patients when the attending physician was unsure about adequate nutrition therapy[88,89].

No significant difference between percutaneous endoscopic gastrostomy (PEG)and nasogastric tube (NGT), with regard to mortality and pneumonia, has been noted. A small randomized controlled trial of a moderate quality study conducted in 104 dysphagic stroke patients showed that, even though a nasal bridle considerably increased the amount of enteral nutrition and fluid delivered, ameliorated electrolyte disturbances, and decreased NGT failure, no differences were seen in terms of mortality, morbidity, PEG placement, functional outcomes or duration of hospital stay at 3 months. The intervention period was limited to 2 weeks[90]. A two-year follow-up study comparing percutaneous endoscopic gastrostomy and nasogastric feeding in 160 patients with swallowing disturbances showed that both techniques are safe and effective in the short term. However, when needed for long-term management, PEG is shown to be superior to NGT feeding in improving nutrition and preventing common challenges for patients with swallowing disturbances[91]. A study by Chang et al. showed that PEG is a better choice than NGT feeding due to the reduction in risk of pneumonia needing

hospital admission, especially in patients with abnormal volumes of pooling secretions collection in the pyriform sinus or leak into the laryngeal vestibule [92]. In a study aimed to assess the role of oropharyngeal dysphagia in older patients on long-term enteral feeding for risk stratification of pneumonia requiring hospitalization, it was reported that PEG is a better choice than NGT. [93] The results of a systematic review showed that percutaneous gastrostomy and NGT have equivalent outcomes in terms of weight management in patients with head and neck cancer. However, considering the evidence available, it is premature to conclude that PEG is advantageous over NGT feeding [94]. The results of the systematic review by Gomes CAR et al. favored PEG compared with NGT owing to the fact that it is associated with a lower probability of intervention failure. However, there is no significant difference in mortality rates between comparison groups or in adverse events, including aspiration pneumonia [95]. A systematic review by JAAFAR et al. showed that definitive conclusions could not be drawn about whether PEG feeding is beneficial over NGT in older patients with non-stroke dysphagia. The pooled analysis results indicated no significant difference in the risk of pneumonia and overall complications between PEG and NG feeding. However, from the studies included in the systematic review, three studies suggested improved mortality outcomes with PEG feeding, but two out of three studies showed that PEG feeding was better from a nutritional perspective [96].

Patients with difficulty in swallowing are at a high risk of aspiration and aspiration pneumonia and developing malnutrition. While aspiration pneumonia cannot be prevented by tube feeding in the acute phase after stroke [88] the rate of aspiration risk does not increase during enteral nutrition [25,96–98]. It is recommended to feed patients at risk of prolonged dysphagia via a tube to avoid the risk of malnutrition, thereby malnutrition [99,100].

Evidence-based practice guidelines by the Dieticians Association of Australia command that the goals of nutritional intervention in head and neck cancer patients undergoing chemo-radiation therapy are to 'reduce a decline in nutritional status/weight to maintain quality of life and symptom management [101].

The results of a meta-analysis have shown that nutritional support through intermittent tube feeding can ensure the nutritional support of the patients, encourage the recovery of swallowing function, and reduce the incidence of aspiration-related pneumonia, providing optimized nutritional support for stroke patients with dysphagia [102]. In Nakajima's study, it was found that intermittent oral-to-oesophageal (IOE) tube feeding was one of the options for continuous nasogastric tube feeding in acute stroke patients with severe dysphagia [103]. In a meta-analysis, it was proven that IOE can better improve the nutritional level of patients and reduce the incidence of complications. The findings showed that IOE tube feeding could improve the nutritional levels of patients better than a nasogastric tube, reduce the incidence of aspiration pneumonia, and improve swallowing function [104]. Intermittent tube feeding can considerably improve the nutritional status on the basis of encouraging the recovery of swallowing function. Intermittent tube feeding has a similar food intake per time to normal people [105].

Long-term indwelling gastric tube leaves a passive effect on the throat reflex, which fails to achieve the effect of training the swallowing function and disuse dysphagia, and patients may need nasal feeding for life [106]. Intermittent tube feeding avoids oesophagus, gastric mucosal damage, and digestive ulcers caused by indwelling a gastric tube, ensures normal digestion and absorption of the digestive tract, and promotes the absorption of nutrients [107].

It has been shown that dysphagia and malnutrition are frequently found together in stroke patients [107,108]. Dysphagia is a strong predictor of malnutrition in stroke patients during the rehabilitation period [109]. While it may not be practically feasible to initiate tube feeding on the first day of treatment in most patients, early initiation of enteral nutrition in acute disease does have several benefits, including fewer infectious complications with tube feeding compared to parenteral nutrition [110,111].

In the "Early versus Avoid trial" of the FOOD study, where tube feeding was started as early as possible versus delayed placement of the tube, it was seen that the group of patients that started enteral nutrition within 7 days of admission had a reduction in mortality by 5.8%, which was not significant. Considering the proportion of patients surviving with poor outcomes was higher in the group with early nutrition, it could be suggested that these patients with an 'impaired outcome' would not have survived with a delayed start of nutrition [88,89]. Hence, enteral nutrition may play an important role.

Prehabilitation nutrition is known to decrease the rate of serious complications significantly [112]. In post-traumatic conditions, amino acids are important for supporting the immune system and promoting tissue repair. [113,114] Prehabilitation nutrition is important in managing the nutritional deficits resulting from the disease [112]. Nutritional support, along with psychoeducation, considerably lowered the overall mortality rate in head and neck cancer patients [112].

3.10 Compensatory techniques

Compensatory techniques are rehabilitative strategies employed for dysphagia management. Several compensatory techniques, such as head flexion, head turn, head tilt, bolus viscosity, texture, and volume modifications, are used for managing dysphagia. The compensatory swallowing techniques target to keep patients safe when swallowing and encourage temporary stability without changing the swallowing mechanism. These techniques include chin tuck,

chin down, head extension, head rotation, effortful swallow, Mendelsohn maneuver, tongue-hold maneuver, or Masako maneuver, supraglottic swallow, and super-supraglottic swallow.

Compensatory methods are used during the swallow to allow effective and safe deglutition despite functional impairments. There are two distinct techniques: postural maneuvers (e.g., chin-tuck or head-turn maneuvers) and special swallowing techniques (e.g., supraglottic swallowing)[25].

The Table 7 provides details about different compensatory techniques[67].

It was seen in an observational study that compensatory swallowing techniques like chin-down posture, head turned posture, and a hyperextended head posture led to safe swallowing in 88% of patients with dysphagia[115]. It has been seen that the effect of both chin tuck and chin down maneuvers was advantageous in swallowing function[116,117]. There is currently no or weak evidence supporting the effect of effortful swallowing, Mendelsohn maneuver, or tongue hold maneuver.

A study has reported that super-supraglottic swallowing changed airway closure and hyoid-larynx movement[118], while another revealed that supraglottic swallowing does not alter the propelling pressure of food lumps[119].

3.11 Bolus viscosity, texture, and volume modifications

In patients with dysphagia, swallowing, and respiration do not have tight temporal coordination. Hence, fluid kinematics or dynamics to evaluate the food bolus flow properties are an important tool to assess swallowing disorders.

Texture-modified food and thickened liquid is a common therapeutic strategy to manage neurogenic dysphagia. It is believed that modifying the properties of normal food and liquids will transform them into a form that is easier and safer to swallow[120].

3.12 Solid and semisolid foods

It is recommended to use modified solid and semisolid foods to promote safe swallowing and adequate nutrition in dysphagia patients. The texture of these is suited to a patient's swallowing ability and palatability. The International Dysphagia Diet Standardization Initiative (IDDSI) has developed global standardized terminology and definitions for texture-modified food and thickened liquids for individuals of all ages, in all care settings, and in all ethnicities and cultures[121].

Clinical or technical assessment should form the basis for recommendation of suitable consistency. Based on the type and severity of the swallowing dysfunction, food should be offered in various consistencies, from pureed to soft textures. Dry, stringy, or crumbly foodstuff should be avoided as they disturb bolus formation. Two-phase food has been seen to increase the risk of aspiration[122]. Nectar- or honey-thickened consistency of fluids may assist in the prevention of aspiration[118]. The results of a systematic review showed that nutritional status can be improved by specially made and nutritionally enriched, texture-modified foods (pureed and minced) and thickened fluids (nectar, honey, and pudding consistency) are recommended for elderly persons with chronic dysphagia[123]. It becomes important to define grades of thickened liquids for dysphagia management. Standardization of thickened liquids used in dysphagia includes the dysphagia phenotype, age, gender, detailed rheological characterization, measurement protocol, and preparation protocol. In a consensus by Krishnamurthy et al., the changes in the food texture have been suggested by the expert committee[123].

Table 8 provides the properties of food texture recommended as the most significant in the modification of solid and semi-solid foods for Indian dysphagia patients[123,124].

Several studies have shown that increasing bolus viscosity from liquid to pudding considerably reduces the prevalence of laryngeal penetration and aspiration in 98.9% of patients. Changing the characteristics of solid food by dicing, chopping, mincing, or pureeing is frequently employed to make these materials easier for oral processing and swallowing[87]. A study has also shown that the minimal massive intervention (MMI) employed through thickening powders reduced hospital readmissions, respiratory infections, and increased survival after the follow-up period.

If seven days have elapsed without the patient achieving an adequate oral intake or if the patient cannot take at least 60% of the estimated daily nutrient demands, it is suggested in the UK national clinical guidelines for diagnosis and initial management of acute stroke and transient ischemic attack that nutritional support with modified texture products should be initiated immediately[80].

Currently, there is a lack of substantial evidence to support the role of texture-modified diets, either alone or along with ONS or enteral tube feeding, in maintaining or improving the nutritional status of dysphagic stroke patients.

In a small study in stroke patients, Diniz et al. showed that modification of diet texture and thickening of fluids can prevent aspiration in stroke patients[125]. However, patients on texture-modified diets may have reduced nutrient intakes than patients on a normal diet[126,127].

A study has shown that semi-solid nutrients significantly reduce the risk of gastroesophageal reflux and the dwell time in the stomach in adult patients[128]. A systematic review by Wu et al. suggested that texture modified diet led to a positive effect on nutritional status and mealtime satisfaction of nutritional fortification. A few modifications of diet texture may be significant for individuals at the highest risk of choking on food[129]. A review has suggested that food thickening to a certain degree can decrease

Table 7. Different compensatory techniques

Compensatory technique	Patients demonstrating	Physiologic changes
Postural manoeuvres		
Chin Tuck (Head flexion)	Decreased airway protection is associated with delayed swallow initiation and/or reduced tongue base retraction.	Expansion of vallecular recesses, approximation of tongue base toward the pharyngeal wall, narrowing entrance to the laryngeal vestibule, reduction in the distance between hyoid and larynx, increased duration of swallowing apnea during the swallow.
Head Rotation (Head turn)	Unilateral pharyngeal and/or laryngeal weakness as well as reduced upper esophageal sphincter opening; reduced laryngeal closure	Redirects the bolus to the side of the pharynx opposite the rotation and drops UES pressure on the side opposite to the head turn. In patients with reduced laryngeal closure, it narrows the laryngeal entrance and increases vocal fold closure by applying extrinsic pressure
Head Tilt	Unilateral oral weakness	Directs the bolus to the stronger side of the oral cavity.
Special swallowing techniques		
Supraglottic swallowing	Reduced airway protection during the swallow.	Increased airway closure by increasing arytenoid approximation and true vocal fold closure and is increasing UES opening during the swallow.
Supra-Supraglottic	Reduced airway closure	Earlier tongue base movement, higher hyoid position at swallow onset, increased hyoid movement and a longer bolus transit time, tongue base and pharyngeal wall contact, and airway closure.
Effortful swallow	Clinically significant residue in the valleculae and/or pyriform sinuses and with decreased airway closure.	Increases hyolaryngeal excursion, duration of hyoid elevation and UES opening, laryngeal closure, lingual pressures, peristaltic amplitudes in the distal oesophagus, and pressure and duration of tongue base retraction.
Mendelsohn	Decreased hyolaryngeal excursion and/or reduced duration of UES opening.	Increases extent and duration of hyolaryngeal excursion, UES
Exercises		
Tongue hold (Masako)	Reduced tongue base and pharyngeal wall contact.	Increases anterior bulging of the posterior pharyngeal wall.
Shaker exercises	Decreased UES opening and weakness of the suprahyoid muscles.	Increases anterior hyolaryngeal excursion, UES opening, strengthening suprahyoid shortening.

#UES: Upper Esophageal Sphincter

the complications of choking, aspiration, reflux, and other complications in patients with dysphagia and also reduce the social disorder, anxiety, and other psychological problems caused by catheterization and surgery.[130] Using thickeners to improve bolus viscosity in post-stroke oral dysphagia patients has been claimed to be a countervailing clinical technique against aspiration[131].

Modified diets are believed to minimize the risk of choking and the need for chewing or oral food processing[132]. Food thickeners play a relevant role in texture-modified food while swallowing, slowing down the flow of liquids and stopping them from being aspired through the airway[133].

The results of a systematic review showed a reduction in the risk of penetration-aspiration with liquids as they move from the thin to the very thick end of the viscosity continuum[120]. It was seen in a study that the use of texture-modified diets along with high-energy, high-protein supplements improved functional and nutritional status in hospital patients with dysphagia[134]. Three studies included in the systematic review found significant weight or BMI improvement with texture modified diet[135–137].

Table 8. Properties and examples of food textures intended for texture-modified diet

Food texture type	Explanation	A few examples
Texture F [very thin]	Thin liquid, homogeneous fluid consistency	Water, coconut water, clear fruit juice, clear dal water, rice kanji, clear vegetable stalk, diluted milk, and very thin buttermilk.
Texture E [Thick]	Liquid or semiliquid consistency, with increased viscosity.	Milkshake, pulpy fruit juice, dal soup, lassi, buttermilk, thick vegetable stalk, shorba.
Texture D [Very thick]	Liquidized/thin puree, homogenous consistency that does not hold its shape after serving	Fruit puree papaya, banana, or other seasonal fruits like melon.
Texture C [Pureed]	Thick puree/soft and smooth, thickened, homogenous consistency that holds its shape after serving	Blended khichdi without seasonings, Pongal (a cereal pulse mixture), curd rice blended, soft, cooked dal rice blended.
Texture B [Soft: Minced]	Soft. Finely minced, cohesive, consistent texture requiring some chewing	Poha cooked, sooji upma, ghee rice with dal.
Texture A [Overcooked]	Normal overcooked food, which can be easily softened by fingers before eating or is very easy to chew.	Khichdi, kheer, soft idli, upma, pongal, dalia.
Modified Normal	Normal foods of varied textures that require chewing	All food items.

However, there is a lack of well-defined boundaries among texture-modified food using rheological measurements and sensory analyses. This has an impact on the treatment of dysphagia since there is a lack of uniform understanding about the texture differences in the food. The results of a meta-analysis including 30 studies concluded that thickening liquids reduce the risk of aspiration in different patient groups. The whole continuum covering the spectrum of viscosity values, from 'thin,' 'nectar,' and 'honey,' to 'spoon thick,' a dose-response characteristic was seen with thicker liquids being safer than thinner liquids[137]. A few studies have also reported that thickened liquids may lead to oral and/or pharyngeal residues with ultra-thick liquids[25].

3.13 Thickened liquids

The primary aim for prescribing thickened liquids for dysphagia patients is to maintain sufficient hydration and prevent aspiration during swallowing. By enhancing the consistency of the bolus, the flow behaviour of the bolus and the physiology of swallowing in dysphagia patients is improved. The use of thickening agents helps dysphagia patients manipulate the bolus properly and makes way for enough time for laryngeal vestibule closure, thus improving airway protection[87].

An article by Newman et al. (2016) showed that increased viscosity from a thin liquid to spoon-thick viscosity significantly reduces laryngeal penetration and aspiration prevalence. However, evidence is lacking to establish the optimal viscosity of boluses ensuring safe swallowing for different dysphagia severity, phenotype, and different swallowing dysfunctions[137]. Besides bolus viscosity, bolus volume also plays a significant role in the safety of swallowing. In the case of patients with pyriform sinuses, an increase in bolus volume leads to a higher chance of overspill into the airway, leading to increased post-swallow residue[138].

3.14 Thickening powders

Thickening powders are used in dysphagia management to slow bolus flow speed during swallowing. With the use of thickening powders, the thickened fluids could be prepared in a simple manner, with convenience, and at a reasonable cost. Thickening agents are notably beneficial for dysphagic patients with delayed swallow, owing to the reduced velocity of bolus flow in comparison to thin liquid[87].

Table 9. Recommendations for the management of dysphagia

Recommendations	Evidence Grade
Clinical Question 1: When and how should the nutritional risk of dysphagia patients be assessed?	
Recommendation 1.0: All patients should be screened for nutritional risk within the first days after hospital admission.	A
Recommendation 1.1: Patients with any obvious or less obvious indicators of dysphagia should be referred to healthcare professionals with relevant skills and training in the diagnosis, assessment, and management of swallowing disorders.	GPP
Recommendation 1.2: Stroke patients at nutritional risk and/or dysphagia should be thoroughly assessed.	A
Recommendation 1.3: All patients should be screened for malnutrition and the risk of malnutrition at the time of admission and then once a week thereafter.	C
Clinical question 2: Are tongue and pharyngeal muscle strengthening exercises effective in improving swallowing function and quality of life, reducing the incidence of pneumonia, and improving quality of life?	
Recommendation 2.0: Tongue and pharyngeal muscle strengthening exercises are recommended in dysphagia patients with stroke, brain lesions, and head and neck cancers performed for 30 minutes per day, 5 times a week.	A
Clinical question 3: Are compensatory swallowing maneuvers effective in improving swallowing function, reducing the occurrence of aspiration pneumonia, and improving quality of life?	
Recommendation 3.0: A compensatory swallowing technique is recommended in patients with dysphagia.	GPP
Clinical Question 4: In what kind of dysphagia patients can tube feeding improve prognosis?	
Recommendations 4.0: Before management, the risks and benefits of modified oral nutrition support and/or enteral tube feeding, along with the potential effects of other factors, should be considered, such as level of alertness, vulnerability, and dependence on others for feeding.	GPP
Recommendation 4.1: It is recommended that enteral feeding should be initiated as soon as clinically feasible after a stroke in patients with severe dysphagia.	A
Recommendation 4.2: A nasogastric tube should be used for short periods of time (up to 1 month) for nutritional support in patients who do not swallow safely.	A
Recommendation 4.3: If enteral feeding is needed for over a month, inserting a feeding tube through percutaneous endoscopic gastrostomy will be beneficial.	C
Recommendations 4.4: For patients in whom early removal of nasogastric tube takes place, the patients should be frequently monitored and followed up.	GPP
Clinical Question 5 (a): Do patients with presumably long-lasting dysphagia benefit from enteral nutrition via a feeding tube? Clinical Question 5 (b): Does enteral tube feeding improve the clinical course, survival, or nutritional status of patients who are likely to have dysphagia for a long period of time? Clinical Question 5 (c): Which route of enteral feeding should be preferred, and what are the indications for a nasogastric tube?	
Recommendation 5.0: Patients with acute stroke who cannot take food and fluids orally should be recommended for enteral feeding with an NGT within 24 hours of admission.	C
Recommendation 5.1: Long-term enteral nutrition is required in cerebral vascular accident patients and patients with other neurological deficits, such as traumatic head injury or neurodegenerative diseases.	GPP
Recommendation 5.2: People admitted to hospitals in general medicine, surgical, and intensive care wards who are malnourished or at risk of malnutrition and have insufficient or unsafe oral intake and a functional, accessible gastrointestinal tract should be fed through a tube into the stomach unless there is upper gastrointestinal dysfunction.	GPP
Recommendation 5.3: In patients with head and neck cancer undergoing radiotherapy, enteral nutrition can be given as a supplement.	GPP
Recommendation 5.4: Enteral nutrition is recommended for post-surgical or trauma patients.	GPP
Recommendation 5.5: Intermittent tube feeding is recommended for stroke patients with dysphagia during the recovery period.	A

Continued on next page

Table 9 continued

Recommendation 5.6: In patients requiring short-term enteral feeding, a nasogastric tube should be used for short periods of time (up to 1 month) for nutritional support in patients with swallowing difficulty.	GPP
Recommendation 5.7: In patients with swallowing difficulty requiring hospital admission, head and neck cancer, and long-term enteral nutrition, PEG tubes are preferred.	A
Clinical Question 6: When should nutrition therapy start in dysphagia patients with swallowing difficulties?	
Recommendation 6.0: All patients detected with swallowing difficulties should be immediately referred for specialist nutritional assessment, advice, and monitoring and given adequate hydration, nutrition, and medication in optional ways.	GPP
Recommendation 6.1: Patients with severe swallowing difficulties owing to which they cannot take food orally for more than 1 week need early enteral nutrition through a feeding tube (at least within 72 hours).	C
Recommendation 6.2: Prehabilitation nutrition support is recommended in head and neck cancer patients.	A
Clinical Question 7 (a): Is texture-modified food or thickened fluid indicated in patients with dysphagia? Clinical Question 7 (b): Does texture modification of food or liquid affect the clinical course (nutrition status or dehydration) of dysphagia?	
Recommendation 7.0: Texture-modified diets, thickened liquids, and/or systematic modifications of bolus size are recommended to be prescribed based on the results of a swallow examination (by speech-language pathologists and/or videofluoroscopic or endoscopic examination).	
Recommendation 7.1: A dietitian should be consulted, and nutrition support should be initiated in cases of insufficient intake over a prolonged period of time. If a dietitian is not available, then any other trained professional should be consulted for the same. Modifying food texture or thickening of fluids should only be used after assessment and monitored by specialized staff speech-language therapists and dietitians).	GPP
Recommendation 7.2: Texture-modified food and thickened fluid is recommended in patients with oropharyngeal dysphagia and in patients with chronic dysphagia to improve their nutritional status.	A
Recommendation 7.3: Thickening of liquids could be used in patients with neurogenic dysphagia who show aspirations with liquids. Different types of thickeners are available and can be used to improve patient compliance.	C
Recommendation 7.4: All stroke patients who need food or fluid of a modified consistency should be referred for specialist nutrition assessment to have the texture of modified foods or liquids prescribed.	GPP
Clinical Question 8: Does nutrition intervention improve intake or nutritional status in patients with dysphagia?	
Recommendation 8.0: Patients with impaired swallowing who are malnourished or at risk of malnutrition should receive supplementary nutritional therapy through a customized (nutritional) plan developed and monitored by a nutritionist in collaboration with a multidisciplinary team.	C
Clinical Question 9: Is the multidisciplinary team approach effective for reducing complications (such as mortality, pneumonia, and other respiratory infections) in patients with dysphagia?	
Recommendation 9.0: All stroke patients should be screened for malnutrition risk within 48 hours of hospitalization by a nurse, doctor, or nutritionist. At-risk patients must be referred to a nutritionist. It is recommended that the assessment and intervention of the nutritionist should be carried out within 24 hours.	GPP
Recommendation 9.1: Patients with dysfunctional swallowing who are either malnourished or at risk of malnutrition should receive supplementary nutritional therapy through a customized nutritional plan developed and monitored by a nutritionist in collaboration with the multidisciplinary team.	GPP

4 Conclusion

Dysphagia could present in acute, subacute, or chronic form due to a plethora of causes arising from the primary organ or from its vicinity or as a part of systemic disease process. In its chronic form, depending on the severity, the nutrition status of a person could deteriorate rapidly, even leading to debilitation. This could further hamper the management of the primary disease particularly when surgical management is deemed necessary. Therefore, it is required to effect a timely nutritional intervention based on early screening, accurate assessment and adequate nutrition via appropriate routes. It is often a challenging task to complete all the steps to achieve a satisfactory outcome. There was a need for a focused guideline focusing on the dysphagia subject, particularly in the Indian scenario, which is not necessarily the same as in other parts of the world. Therefore, a consensus statement was brought out by a host of experts from diverse fields associated with the management of dysphagia patients. A total of 12 recommendations with subdivisions were formulated in two groups: one set for the diagnosis (3 recommendations) and the other for the management (9 recommendations). The diagnostic approach consisted of a focussed clinical history, aspiration screening, dysphagia assessment through (i) clinical swallowing examination (CSE), (ii) Flexible endoscopic evaluation screening (FEES), (iii) VFSS, (iv) Manometry and (v) Electromypraphy.

The management included (i) risk assessment (ii) rehabilitation through enteral nutrition, and (iii) compensatory techniques including postural manouver, special swallowing techniques, exercises, bolus viscosity, texture, and volume modifications.

We believe that the recommendations could be an easy to fruitful guide in the nutritional management of dysphagia. A corollary to this would be to validate these in prospective studies.

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References

1) Rajati F, Ahmadi N, Naghibzadeh ZA, Kazeminia M. The global prevalence of oropharyngeal dysphagia in different populations: a systematic review and meta-analysis. *Journal of Translational Medicine*. 2022;20:1–15. Available from: https://doi.org/10.1186/s12967-022-03380-0.
2) Adkins C, Takakura W, Spiegel B, Lu M, et al. Prevalence and characteristics of dysphagia based on a population-based survey. *Clinical Gastroenterology and Hepatology*. 2020;18(9):1970–1979. Available from: https://doi.org/10.1016/j.cgh.2019.10.029.
3) Kertscher B, Speyer R, Fong E, et al. Prevalence of oropharyngeal dysphagia in the Netherlands: A telephone survey. *Dysphagia*. 2015;30(2):114–120. Available from: https://doi.org/10.1007/s00455-014-9584-z.
4) Takizawa C, Gemmell E, Kenworthy J, Speyer R. A systematic review of the prevalence of oropharyngeal dysphagia in stroke, Parkinson's disease, Alzheimer's disease, head injury, and pneumonia. *Dysphagia*. 2016;31(3):434–441. Available from: https://doi.org/10.1007/s00455-016-9695-9.
5) Font MM, Salsench LR. Antipsychotic medication and oropharyngeal dysphagia: systematic review. *European Journal of Gastroenterology & Hepatology*. 2017;29(12):1332–1339. Available from: https://doi.org/10.1097/meg.0000000000000983.
6) Mitra T, Dixit VK, Shukla SK, Yadav DP, Thakur P, Thakur RK. Clinical profile of patients presenting with dysphagia-an experience from a tertiary care centre in North India. *JGH Open*. 2019;4(3):472–476. Available from: https://doi.org/10.1002/jgh3.12284.
7) Sahu S, Kher KS, Wagh DD, Swarnakar M, Pandey P, Agnihotri I. Endoscopic evaluation of patients presenting with dysphagia at rural hospital AVBRH. *Journal of Datta Meghe Institute of Medical Sciences University*. 2017;12(3):196–205. Available from: https://doi.org/10.4103/jdmimsu.jdmimsu_85_17.
8) Krishnamurthy R, Balasubramanium RK, Premkumar PK. Systematic review and meta-analysis of dysphagia and associated pneumonia in patients with stroke from India: A call to arms. *American Journal of Speech-Language Pathology*. 2022;31(1):502–514. Available from: https://doi.org/10.1044/2021_ajslp-21-00175.
9) Aslam M, Vaezi MF. Dysphagia in the elderly. *Gastroenterology & Hepatology (N Y)*. 2013;9(12):784–795. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC3999993/.
10) Wolf DC. Clinical Methods: The History, Physical, and Laboratory Examinations. 3rd ed. Walker HK, Hall WD, Hurst JW, editors;Boston. Butterworths Publishers. 1990. Available from: https://pubmed.ncbi.nlm.nih.gov/21250045/.
11) Leopold NA, Kagel MC. Dysphagia in Huntington's disease. *Archives of neurology*. 1985;42(1):57–60. Available from: https://doi.org/10.1001/archneur.1985.04060010063017.
12) Camilleri M, Dubois D, Coulie B, et al. Prevalence and socioeconomic impact of upper gastrointestinal disorders in the United States: results of the US upper gastrointestinal study. *Clinical Gastroenterology and Hepatology*. 2005;3(6):543–552. Available from: https://doi.org/10.1016/S1542-3565(05)00153-9.
13) Peery AF, Crockett SD, Murphy CC, et al. Burde and cost of gastrointestinal, liver, and pancreatic diseases in the United States: update 2018. *Gastroenterology*. 2019;156(1):254–272. Available from: https://doi.org/10.1053/j.gastro.2018.08.063.
14) Miller R, Prain M, Hagiliassis N, Wilson J. Quality mealtime support project. *Intellectual disability Australasia*. 2014;35(2):1–5. Available from: https://search.informit.org/doi/abs/10.3316/informit.646294424696532.
15) Bazemore PH, Tonkonogy J, Ananth R. Dysphagia in psychiatric patients: clinical and videofluoroscopic study. *Dysphagia*. 1991;6(1):2–5. Available from: https://doi.org/10.1007/bf02503456.
16) Chang MC, Choo YJ, Seo KC, Yang S. The Relationship Between Dysphagia and Pneumonia in Acute Stroke Patients: A Systematic Review and Meta-Analysis. *Frontiers in Neurology*. 2022;13:1–8. Available from: https://doi.org/10.3389/fneur.2022.834240.
17) Marik PE, Kaplan D. Aspiration pneumonia and dysphagia in the elderly. *Chest*. 2003;124(1):328–336. Available from: https://doi.org/10.1378/chest.124.1.328.
18) Chen K, Xing L, Xu B, Li Y, et al. Research progress in the risk factors and screening assessment of dysphagia in the elderly. *Frontiers in Medicine*. 2022;9:1–9. Available from: https://doi.org/10.3389/fmed.2022.1021763.

19) Bischoff SC, Singer P, Koller M, Barazzoni R, Cederholm T, van Gossum A. Standard operating procedure for ESPEN guidelines and consensus papers. *Clinical Nutrition*. 2015;34(6):1043–1051. Available from: https://www.clinicalnutritionjournal.com/article/S0261-5614(15)00185-5/fulltext.
20) Scottish Intercollegiate Guidelines Network 50. A guideline developer's handbook. Revised version. Edinburg. 2019. Available from: https://www.sign.ac.uk/media/2038/sign50_2019.pdf.
21) Audag N, Goubau C, Toussaint M, Reychler G. Screening and evaluation tools of dysphagia in adults with neuromuscular diseases: a systematic review. *Therapeutic Advances in Chronic Disease*. 2019;10:1–15. Available from: https://doi.org/10.1177/2040622318821622.
22) Johnston BT. Oesophageal dysphagia: a stepwise approach to diagnosis and management. *The Lancet Gastroenterology and Hepatology*. 2017;2(8):604–609. Available from: https://doi.org/10.1016/s2468-1253(17)30001-8.
23) Fedder WN. Review of evidence-based nursing protocols for dysphagia assessment. *Stroke*. 2017;48(4):e99–e101. Available from: https://doi.org/10.1161/STROKEAHA.116.011738.
24) Virvidaki IE, Nasios G, Kosmidou M, Giannopoulos S, Milionis H. Swallowing and aspiration risk: A critical review of non-instrumental bedside screening tests. *Journal of Clinical Neurology*. 2018;14(3):265–274. Available from: https://doi.org/10.3988/jcn.2018.14.3.265.
25) Dziewas R, Allescher HD, Aroyo I, Bartolome G, et al. Diagnosis and treatment of neurogenic dysphagia-S1 guideline of the German Society of Neurology. *Neurological Research and Practice*. 2021;3:1–30. Available from: https://doi.org/10.1186/s42466-021-00122-3.
26) Marian T, Schroder J, Muhle P, Clause I, et al. Measurement of Oxygen Desaturation Is Not Useful for the Detection of Aspiration in Dysphagic Stroke Patients. *Cerebrovascular Diseases Extra*. 2017;7(1):44–50. Available from: https://doi.org/10.1159/000453083.
27) Warnecke T, Dziewas R, Wirth R, Bauer JM, Prell T. Dysphagia from a neurogeriatric point of view: Pathogenesis, diagnosis, and management. *Zeitschrift fur Gerontologie und Geriatrie*. 2019;52(4):330–335. Available from: https://doi.org/10.1007/s00391-019-01563-x.
28) Pflug C, Bihler M, Emich K, Niessen A, et al. Critical dysphagia is common in Parkinson's disease and occurs even in early stages: a prospective cohort study. *Dysphagia*. 2018;33(1):41–50. Available from: https://doi.org/10.1007/s00455-017-9831-1.
29) Lakshminarayan K, Tsai AW, Tong X, Vazquez G, et al. Utility of dysphagia screening results in predicting post-stroke pneumonia. *Stroke*. 2010;41(12):2849–2854. Available from: https://doi.org/10.1161/strokeaha.110.597039.
30) Hinchey JA, Shephard T, Furie K, Smith D, et al. Formal dysphagia screening protocols prevent pneumonia. *Stroke*. 2005;36(9):1972–1976. Available from: https://doi.org/10.1161/01.str.0000177529.86868.8d.
31) Titsworth WL, Abram J, Fullerton A, Hester J, et al. Prospective quality initiative to maximize dysphagia screening reduces hospital-acquired pneumonia prevalence in patients with stroke. *Stroke*. 2013;44(11):3154–3160. Available from: https://doi.org/10.1161/strokeaha.111.000204.
32) Bray BD, Smith CJ, Cloud GC, Enderby P, et al. The association between delays in screening for and assessing dysphagia after acute stroke, and the risk of stroke-assocaited pneumonia. *Neurosurgery, and Psychiatry*. 2017;88(1):25–30. Available from: https://doi.org/10.1136/jnnp-2016-313356.
33) Al-Khaled M, Matthis C, Binder A, Mudter J, et al. Dysphagia in patients with acute ischemic stroke: early dysphagia screening may reduce stroke-related pneumonia and improve stroke outcomes. *Cerebrovascular diseases*. 2016;42(1-2):81–89. Available from: https://doi.org/10.1159/000445299.
34) Rangarathnam B, McCullough GH. Utility of a clinical swallowing exam for understanding swallowing physiology. *Dysphagia*. 2016;31(4):491–497. Available from: https://doi.org/10.1007/s00455-016-9702-1.
35) Mann G, Dip PG, Hankey GJ, Cameron D. Swallowing function after stroke. *Stroke*. 1999;30(4):744–748. Available from: https://doi.org/10.1161/01.STR.30.4.744.
36) Barer DH. The natural history and functional consequences of dysphagia after hemispheric stroke. *Journal of Neurology, Neurosurgery and Psychiatry*. 1989;52(2):236–241. Available from: https://doi.org/10.1136/jnnp.52.2.236.
37) Gordon C, Hewer RL, Wade DT. Dysphagia in acute stroke. *British Medical Journal* . 1987;295(6595):411–414. Available from: https://doi.org/10.1136/bmj.295.6595.411.
38) Smith HA, Lee SH, O'Neill PA, Connolly MJ. The combination of bedside swallowing assessment and oxygen saturation monitoring of swallowing in acute stroke: a safe and humane screening tool. *Age Ageing*. 2000;29(6):495–499. Available from: https://doi.org/10.1093/ageing/29.6.495.
39) Kleindorfer D, Panagos P, Pancioli A, Khory J, et al. Incidence and short-term prognosis of transient ischemicic attack in a population-based study. *Stroke*. 2005;36(4):720–723. Available from: https://doi.org/10.1161/01.str.0000158917.59233.b7.
40) Carnaby G, Hankey GJ, Pizzi J. Behavioural intervention for dysphagia in acute stroke: a randomized controlled trial. *Lancet Neurology*. 2006;5(1):31–37. Available from: https://doi.org/10.1016/s1474-4422(05)70252-0.
41) Adult Dysphagia (Practice Portal). *American Speech-Language-Hearing Association*. 2024. Available from: https://www.asha.org/practice-portal/clinical-topics/adult-dysphagia/.
42) Rosenbeck JC, Robbins JA, Roecker EB, Coyle JL, Wood JL. A penetration-aspiration scale. *Dysphagia*. 1996;11(2):93–98. Available from: https://doi.org/10.1007/bf00417897.
43) Neubauer PD, Rademaker AW, Leder SB. The Yale Pharyngeal Residue Severity Rating Scale: An Anatomically Defined and Image-Based Tool. *Dysphagia*. 2015;30(5):521–528. Available from: https://doi.org/10.1007/s00455-015-9631-4.
44) Murray J, Langmore SE, Ginsberg S, Dostie A. The significance of accumulated oropharyngeal secretions and swallowing frequency in predicting aspiration. *Dysphagia*. 1996;11(2):99–103. Available from: https://doi.org/10.1007/bf00417898.
45) Warnecke T, Suttrup I, Schroder JB, Osada N, et al. Levodopa responsiveness of dysphagia in advanced Parkinson's disease and reliability testing of the FEES-Levodopa-test. *Parkinsonism & Related Disorders*. 2016;28:100–106. Available from: https://doi.org/10.1016/j.parkreldis.2016.04.034.
46) Warnecke T, Dziewas R. Neurogene Dysphagien. Diagnostik und Therapie. 2nd ed. Kohlhammer. 2018. Available from: https://doi.org/10.17433/978-3-17-030532-8.
47) Braun T, Juenemann M, Virad M, Meyer M, et al. What is the value of fibre-endoscopic evaluation of swallowing (FEES) in neurological patients? A cross-sectional hospital-based registry study. *BMJ Open*. 2018;8(3):1–7. Available from: https://doi.org/10.1136/bmjopen-2017-019016.
48) Bax L, McFarlane M, Green E, Miles A. Speech-language pathologist-led fiberoptic endoscopic evaluation of swallowing: functional outcomes for patients after stroke. *Journal of Stroke and Cerebrovascular Diseases*. 2014;23(3):195–200. Available from: https://doi.org/10.1016/j.jstrokecerebrovasdis.2013.09.031.
49) Rofes L, Arreola V, Maritn A, Clave P. Natural capsaicinoids improve swallow response in older patients with oropharyngeal dysphagia. *Gut*. 2013;62(9):1280–1287. Available from: https://doi.org/10.1136/gutjnl-2011-300753.
50) Clave P, De Kraa M, Arreola V, Girvent M, Farré R, Palomera E, et al. The effect of bolus viscosity on swallowing functionin neurogenic dysphagia. *Alimentary Pharmacology & Therapeutics*. 2006;24(9):1385–1394. Available from: https://doi.org/10.1111/j.1365-2036.2006.03118.x.
51) Seo HG, Oh BM, Han TR. Longitudinal changes of the swallowing process in subacute stroke patients with aspiration. *Dysphagia*. 2011;26(1):41–48. Available from: https://doi.org/10.1007/s00455-009-9265-5.

52) Park JM, Yong SY, Kim JH, Jung HS, et al. Cutoff value of pharyngeal residue in prognosis prediction after neuromuscular electrical stimulation therapy for dysphagia in subacute stroke patients. *Annals of Rehabilitation Medicine*. 2014;38(5):612–619. Available from: https://doi.org/10.5535/arm.2014.38.5.612.
53) Garand KL, Strange C, Paoletti L, Hopkins-Rossabi T, Martin-Harris B. Oropharyngeal swallow physiology and swallowing-related quality of life in underweight patients with concomitant advanced chronic obstructive pulmonary disease. *International journal of chronic obstructive pulmonary disease*. 2018;13:2663–2671. Available from: https://doi.org/10.2147/copd.s165657.
54) Tabor LC, Plowman EK, Romero-Clark C, Youssof S. Oropharyngeal dysphagia profiles in individuals with oculopharyngeal muscular dystrophy. *Neurogastroenterology and Motility*. 2018;30(4):13251. Available from: https://doi.org/10.1111/nmo.13251.
55) Plowman EK, Tabor-Gray L, Rosado KM, Vasilopoulos T, et al. Impact of expiratory strength training in amyotrophic lateral sclerosis: Results of a randomized, sham-controlled trial. *Muscle & Nerve*. 2019;59(1):40–46. Available from: https://doi.org/10.1002/mus.26292.
56) Tomita S, Oeda T, Umemura A, Kohsaka M, et al. Video-fluoroscopic swallowing study scale for predicting aspiration pneumonia in Parkinson's disease. *PLoS One*. 2018;13(6):1–14. Available from: https://doi.org/10.1371/journal.pone.0197608.
57) Hwang JM, Cheong YS, Kang MG, Chun SM, et al. Recommendation of nasogastric tube removal in acute stroke patients based on videofluoroscopic swallow study. *Annals of Rehabilitation Medicine*. 2017;41(1):9–15. Available from: https://doi.org/10.5535/arm.2017.41.1.9.
58) Pandolfino JE, Fox MR, Bredenoord AJ, Kahrila PJ. High-resolution manometry in clinical practice: utilizing pressure topography to classify oesophageal motility abnormalities. *Neurogastroenterology and Motility*. 2009;21(8):796–806. Available from: https://doi.org/10.1111/j.1365-2982.2009.01311.x.
59) Kahrilas PJ, Bredenoord AJ, Fox M, Gyawali CP, et al. The Chicago classification of esophageal motility disorders. *Neurogastroenterology and Motility*. 2015;27(2):160–174. Available from: https://doi.org/10.1111/nmo.12477.
60) Claus I, Suttrup J, Muhle P, Suntrup-Krueger S, et al. Subtle esophageal motility alterations in Parkinsonia syndromes: synucleinopathies vs. tauopathies. *Movement Disorders Clinical Practice*. 2018;5(4):406–412. Available from: https://doi.org/10.1002/mdc3.12616.
61) Casal-Dominguez M, Pinal-Fernandez I, Mego M, Accarino A, et al. High-resolution manometry in patients with idiopathic inflammatory myopathy: Elevated prevalence of esophageal involvement and differences according to autoantibody status and clinical subset. *Muscle & Nerve*. 2017;56(3):386–392. Available from: https://doi.org/10.1002/mus.25507.
62) Lee TH, Lee JS, Kim WJ. High resolution impedance manometric findings in dysphagia of Huntington's disease. *World Journal of Gastroenterology*. 2012;18(14):1695–1699. Available from: https://doi.org/10.3748/wjg.v18.i14.1695.
63) Knigge MA, Thibeault SL. Swallowing outcomes after cricopharyngeal myotomy: A systematic review. *Head and neck*. 2018;40(1):203–212. Available from: https://doi.org/10.1002/hed.24977.
64) Lee WK, Yeom J, Lee WH, Seo HG. Characteristics of dysphagia in severe traumatic brain injury patients: a comparison with stroke patients. *Annals of rehabilitation Medicine*. 2016;40(3):432–439. Available from: https://doi.org/10.5535/arm.2016.40.3.432.
65) Jones CA, Ciucci MR. Multimodal swallowing evaluation with high-resolution manometry reveals subtle swallowing changes in early and mid-stage Parkinson's disease. *Journal of Parkinson's Disease*. 2016;6(1):197–208. Available from: https://doi.org/10.3233/jpd-150687.
66) Jungheim M, Kuhn D, Ptok M. High resolution manometry study of pharyngeal function in patients with myotonic dystrophy. *Der Nervenarzt*. 2015;86(8):997–1006. Available from: https://doi.org/10.1007/s00115-015-4397-3.
67) Vose A, Nonnenmacher J, Singer ML, Gonzalez-Fernandez M. Dysphagia management in acute and sub acute stroke. *Current Physical Medicine and Rehabilitation Reports*. 2014;2(4):197–206. Available from: https://doi.org/10.1007/s40141-014-0061-2.
68) Wirth R, Smoliner C, Jager M, Warnecke T. Guideline clinical nutrition in patients with stroke. *Experimental & Translational Stroke Medicine*. 2013;5(1):1–11. Available from: https://doi.org/10.1186/2040-7378-5-14.
69) de Jesus Oliveira I, Couto GR, Santos RV, Campolargo AM, Lima C, Ferreira PL. Best Practice Recommendations for Dysphagia Management in Stroke Patients: A Consensus from a Portuguese Expert Panel. *Portuguese Journal of Public Health*. 2022;39(3):145–162. Available from: https://doi.org/10.1159/000520505.
70) Mancin S, Sguanci M, Reggiani F, Morenchi E, Piredda M, De Marinis MG. Dysphagia screening post-stroke: systematic review. *BMJ Supportive & Palliative Care*. 2024;13(e3):e641–e650. Available from: https://doi.org/10.1136/spcare-2022-004144.
71) Simon SR, Pilz W, Hoebers FJP, et al. Malnutrition screening in head and neck cancer patients with oropharyngeal dysphagia. *Clinical Nutrition ESPEN*. 2021;44:348–355. Available from: https://doi.org/10.1016/j.clnesp.2021.05.019.
72) Lazarus CL, Husaini H, Falciglia D, Delacure M, et al. Effects of exercise on swallowing and tongue strength in patients with oral and oropharyngeal cancer treated with primary radiotherapy with or without chemotherapy. *International Journal of Oral and Maxillofacial Surgery*. 2014;43(5):523–530. Available from: https://doi.org/10.1016/j.ijom.2013.10.023.
73) Mepani R, Antonik S, Massey B, Kern M, et al. Augmentation of deglutitive thyrohyoid muscle shortening by the Shaker Exercise. *Dysphagia*. 2009;24(1):26–31. Available from: https://doi.org/10.1007/s00455-008-9167-y.
74) Yang S, Park JW, Min K, Lee YS, et al. Clinical practice guidelines for oropharyngeal dysphagia. *Annals of Rehabilitation Medicine*. 2023;47(Suppl 1):S1–S26. Available from: https://doi.org/10.5535/arm.23069.
75) Kang TW, Kim BR. The effects of head-lift exercise on swallowing function in patients with stroke. *Journal of The Korean Society of Physical Medicine*. 2018;13(2):89–95. Available from: https://doi.org/10.13066/kspm.2018.13.2.89.
76) McCullough GH, Kamarunas E, Mann GC, Schmidley J, et al. Effects of Mendelsohn Maneuver on measures of swallowing duration post-stroke. *Topics in Stroke Rehabilitation*. 2012;19(3):234–243. Available from: https://doi.org/10.1310/tsr1903-234.
77) McCullough GH, Kim Y. Effects of the Mendelsohn Maneuver on extent of hyoid movements and UES opening post-stroke. *Dysphagia*. 2013;28(4):1–18. Available from: https://doi.org/10.1007/s00455-013-9461-1.
78) Kotz T, Federman AD, Kao J, Milman L, et al. Prophylactic swallowing exercises in patients with head and neck cancer undergoing chemoradiation: a randomized trial. *The Archives of Otolaryngology–Head & Neck Surgery*. 2012;138(4):376–382. Available from: https://doi.org/10.1001/archoto.2012.187.
79) Ojo O, Brooke J. The use of enteral nutrition in the management of stroke. *Nutrients*. 2016;8(12):1–6. Available from: https://doi.org/10.3390/nu8120827.
80) Stroke: National Clinical Guideline for Diagnosis and Initial Management of Acute Stroke and Transient Ischaemic Attack (TIA). London, UK. Royal College of Physicians. 2008. Available from: https://pubmed.ncbi.nlm.nih.gov/21698846/.
81) Hebert D, Lindsay MP, Mcintyre A, Kirton A, et al. Canadian stroke best practice recommendations: stroke rehabilitation practice guidelines, update 2015. *International Journal of Stroke*. 2016;11(4):459–484. Available from: https://doi.org/10.1177/1747493016643553.
82) Burgos R, Breton I, Cereda E, Desport JC, et al. ESPEN guideline clinical nutrition in neurology. *Clinical Nutrition*. 2018;37(1):354–396. Available from: https://www.clinicalnutritionjournal.com/article/S0261-5614(17)30318-7/fulltext.

83) Boulanger JM, Lindsay MP, Gubitz G, Smith EE, et al. Canadian Stroke Best Practice Recommendations for Acute Stroke Management: Prehospital, Emergency Department, and Acute Inpatient Stroke Care, 6th Edition, Update 2018. *International Journal of Stroke*. 2018;13(9):949–984. Available from: https://doi.org/10.1177/1747493018786616.

84) Powers WJ, Rabinstein AA, Ackerson T, et al. 2018 Guidelines for the Early Management of Patients With Acute Ischemic Stroke: A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association. *Stroke*. 2018;49(3):46–110. Available from: https://doi.org/10.1161/str.0000000000000158.

85) Winstein CJ, Stein J, Arena R, Bates B, et al. Guidelines for Adult Stroke Rehabilitation and Recovery: A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association. *Stroke*. 2016;47(6):e98–e169. Available from: https://doi.org/10.1161/str.0000000000000098.

86) Wirth R, Smoliner C, Jager M, Warnecke T, Leichker AH, et al. Guideline clinical nutrition in patients with stroke. *Experimental & Translational Stroke Medicine*. 2013;5(1):1–11. Available from: https://doi.org/10.1186/2040-7378-5-14.

87) Gallegos C, de la Fuente EB, Clave P, Costa A, Assegehegn G. Nutritional Aspects of Dysphagia Management. *Advances in Food and Nutrition Research*. 2017;81:271–318. Available from: https://doi.org/10.1016/bs.afnr.2016.11.008.

88) Dennis MS, Lewis SC, Warlow C. Effect of timing and method of enteral tube feeding for dysphagic stroke patients (FOOD): a multicentre randomized controlled trial. *Lancet*. 2005;365(9461):764–772. Available from: https://doi.org/10.1016/s0140-6736(05)17983-5.

89) Dennis M, Lewis S, Cranswick G, Forbes J. FOOD: a multicentre randomised trial evaluating feeding policies in patients admitted to hospital with a recent stroke. *Health technology assessment* . 2006;10(2):iii–iv, ix–x, 1–120. Available from: https://doi.org/10.3310/hta10020.

90) Beavan J, Conroy SP, Harwood R, Gladman JRF, et al. Does looped nasogastric tube feeding improve nutritional delivery for patients with dysphagia after acute stroke? A randomized controlled trial. *Age ageing*. 2010;39(5):624–630. Available from: https://doi.org/10.1093/ageing/afq088.

91) Du G, Liu F, Ma X, Chen S, et al. Comparison Between Percutaneous Endoscopic Gastrostomy and Nasogastric Feeding in 160 Patients with Swallowing Disturbances: A Two-Year Follow-Up Study. *Clinical Interventions in Aging*. 2022;17:1803–1810. Available from: https://doi.org/10.2147/cia.s389891.

92) Chang WK, Huang HH, Lin HH, Tsai CL. Percutaneous Endoscopic Gastrostomy versus Nasogastric Tube Feeding: Oropharyngeal Dysphagia Increases Risk for Pneumonia Requiring Hospital Admission. *Nutrients*. 2019;11(12):1–10. Available from: https://doi.org/10.3390/nu11122969.

93) Lin TH, Yang CW, Chang WK. Evaluation of oropharyngeal dysphagia in older patients for risk stratification of pneumonia. *Frontiers in Immunology*. 2022;12:1–9. Available from: https://doi.org/10.3389/fimmu.2021.800029.

94) Wang J, Liu M, Liu C, Ye Y, Huang G. Percutaneous endoscopic gastrostomy versus nasogastric tube feeding for patients with head and neck cancer: a systematic review. *Journal of Radiation Research*. 2014;55(3):559–567. Available from: https://doi.org/10.1093/jrr/rrt144.

95) Gomes CAR, Andriolo RB, Bennett C, Lustosa SAS, et al. Percutaneous endoscopic gastrostomy versus nasogastric tube feeding for adults with swallowing disturbances. *Cochrane Database of Systematic reviews*. 2015;(5):1–62. Available from: https://doi.org/10.1002/14651858.CD008096.pub4.

96) Jaafar MH, Mahadeva S, Morgan K, Tan MP. Percutaneous endoscopic gastrostomy versus nasogastric feeding in older individuals with non-stroke dysphagia: A systematic review. *The Journal of nutrition, health and aging*. 2015;19(2):190–197. Available from: https://doi.org/10.1007/s12603-014-0527-z.

97) Finucane TE, Bynum JPW. Use of tube feeding to prevent aspiration pneumonia. *Lancet*. 1996;348(9039):1421–1424. Available from: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(96)03369-7/abstract.

98) Mamun K, Lim J. Role of nasogastric tube in preventing aspiration pneumonia in patients with dyspahgia. *Singapore Medical Journal*. 2005;46(11):627–631. Available from: https://pubmed.ncbi.nlm.nih.gov/16228094/.

99) Finestone HM, Greene-Finestone LS, Wilson ES, Teasell RW. Prolonged length of stay and reduced functional improvement rate in lamnourished stroke rehabilitation patients. *Archives of Physical Medicine and Rehabilitation*. 1996;77(4):340–345. Available from: https://doi.org/10.1016/s0003-9993(96)90081-7.

100) Gariballa SE, Parker SG, Taub N, Castleden CM. Influence of nutritional status on clinical outcome after acute stroke. *The American Journal of Clinical Nutrition*. 1998;68(2):275–281. Available from: https://doi.org/10.1093/ajcn/68.2.275.

101) Isenring E, Zabel R, Bannister M, et al. Updated evidence-based practice guidelines for the nutritional management of patients receiving radiation therapy and/or chemotherapy: 2012 Radiation therapy and/or chemotherapy nutrition guidelines. *Nutrition and Dietetics*. 2013;70(4):312–324. Available from: https://doi.org/10.1111/1747-0080.12013.

102) Wu C, Zhu X, Zhou X, Li C, et al. Intermittent tube feeding for stroke patients with dysphagia: a meta-analysis and systematic review. *Annals of Palliative Medicine*. 2021;10(7):7406–7415. Available from: https://doi.org/10.21037/apm-21-736.

103) Nakajima M, Kimura K, Inatomi Y, et al. Intermittent oro-esophageal tube feeding in acute stroke patients- a pilot study. *Acta Neurologica Scandinavica*. 2006;113(1):36–39. Available from: https://doi.org/10.1111/j.1600-0404.2005.00534.x.

104) Wang S, Zeng X, Zhang Q, Li H. Effectiveness of different feeding techniques for post-stroke dysphagia: An updated systematic review and meta analysis. *Intensive Care Research*. 2022;2:108–116. Available from: https://doi.org/10.1007/s44231-022-00022-3.

105) Trapl M, Enderle P, Nowotny M, et al. Dysphagia bedside screening for acute-stroke patients: the Gugging Swallowing Screen. *Stroke*. 2007;38(11):2948–2952. Available from: https://doi.org/10.1161/strokeaha.107.483933.

106) Rowat A. Enteral tube feeding for dysphagic stroke patients. *British Journal of Nursing*. 2015;24(3):138, 140, 142–145. Available from: https://doi.org/10.12968/bjon.2015.24.3.138.

107) Shimazu S, Yoshimara Y, Kudo M, et al. Frequent and personalized nutritional support leads to improved nutritional status, activities of daily living, and dysphagia after stroke. *Nutrition*. 2021;83:111091. Available from: https://doi.org/10.1016/j.nut.2020.111091.

108) Umay E, Eyigor S, Ertekin C. Best Practice Recommendations for Stroke Patients with Dysphagia: A Delphi-Based Consensus Study of Experts in Turkey-Part I: Management, Diagnosis, and Follow-up. *Dysphagia*. 2022;37(2):217–236. Available from: https://doi.org/10.1007/s00455-021-10273-9.

109) Finniss MC, Myers JW, Wilson JR, Wilson VC, Lewis PO. Dysphagia after Stroke: An Unmet Antibiotic Stewardship Opportunity. *Dysphagia* . 2022;37(2):260–265. Available from: https://doi.org/10.1007/s00455-021-10269-5.

110) Kudsk KA, Croce MA, Fabian TC, Minard G, et al. Enteral versus parenteral feeding. Effects on septic morbidity after blunt and penetrating abdominal trauma. *Annals of Surgery*. 1992;215(5):503–511. Available from: https://doi.org/10.1097/00000658-199205000-00013.

111) Gramlich L, Kichian K, Pinilla J, Rodych NJ, et al. Does enteral nutrition compared to parenteral nutrition result in better outcomes in critically ill adult patients? A systematic review of the literature. *Nutrition*. 2004;20(10):843–848. Available from: https://doi.org/10.1016/j.nut.2004.06.003.

112) Seth I, Bulloch G, Qin KR, Xie Y, et al. Pre-rehabilitation interventions for patients with head and neck cancers: A systematic review and meta-analysis. *Head & Neck*. 2024;46(1):86–117. Available from: https://doi.org/10.1002/hed.27561.

113) Arribas-Lopez E, Zand N, Ojo O, Snowden MJ, Kochhar T. The effect of amino acids on wound healing: a systematic review and meta-analysis on arginine and glutamine. *Nutrients*. 2021;13(8):1–26. Available from: https://doi.org/10.3390/nu13082498.

114) Cruzat V, Rogero MM, Keane KN, Curi R, Newsholme P. Glutamine: Metabolism and Immune Function, Supplementation and Clinical Translation. *Nutrients*. 2018;10(11):1–31. Available from: https://doi.org/10.3390/nu10111564.

115) Solazzo A, Monaco L, Vecchio LD, Tamburini S, et al. Investigation of compensatory postures with videofluoromanometry in dysphagia patients. *World Journal of Gastroenterology*. 2012;18(23):2973–2978. Available from: https://doi.org/10.3748/wjg.v18.i23.2973.

116) Ra JY, Hyun JK, Ko KR, Lee SJ. Chin tuck for prevention of aspiration: effectiveness and appropriate posture. *Dysphagia*. 2014;29(5):603–609. Available from: https://doi.org/10.1007/s00455-014-9551-8.

117) Miyamoto T, Kumai Y, Matsubara K, Kodama N, Satoh C, Orita Y. Different types of dysphagia alleviated by the chin-down position. *Auris Nasus Larynx*. 2021;48(5):928–933. Available from: https://doi.org/10.1016/j.anl.2021.02.008.

118) Logemann JA, Pauloski BR, Rademaker AW, Colangelo LA. Super-supraglottic swallow in irradiated head and neck cancer patients. *Head Neck*. 1997;19(6):535–540. Available from: https://doi.org/10.1002/(sici)1097-0347(199709)19:6%3C535::aid-hed11%3E3.0.co;2-4.

119) Bulow M, Olsson R, Ekberg O. Supraglottic swallow, effortful swallow, and chin tuck did not alter hypopharyngeal intrabolus pressure in patients with pharyngeal dysfunction. *Dysphagia*. 2002;17(3):197–201. Available from: https://doi.org/10.1007/s00455-002-0050-y.

120) Steele CM, Alsanei WA, Ayanikalath S, Barbon CE, et al. The influence of food texture and liquid consistency modification on swallowing physiology and function: A systematic review. *Dysphagia*. 2015;30(1):2–26. Available from: https://doi.org/10.1007/s00455-014-9578-x.

121) Ozaki K, Kagaya H, Yokoyama M, Saitoh E, et al. The risk of penetration or aspiration during video fluoroscopic examination of swallowing varies depending on food types. *The Tohoku Journal of Experimental Medicine*. 2010;220:41–46. Available from: https://doi.org/10.1620/tjem.220.41.

122) Anderson UT, Beck AM, Kjaersgaard A, Hansen T. Systematic review and evidence based recommendations on texture modified foods and thickened fluids for adults (≥18 years) with oropharyngeal dysphagia. *e-SPEN Journal*. 2013;8(4):e127–e134. Available from: https://doi.org/10.1016/j.clnme.2013.05.003.

123) Krishnamurthy A, Timmanpyati S, Meenakshi S, Canday E, et al. IAPEN INDIA consensus statement on nutritional management in head and neck cancers. *Journal of Nutrition Research*. 2023;11(1):6–19. Available from: https://doi.org/10.55289/jnutres/v11i1_22.20.

124) Texture-modified foods and thickened fluids as used for individuals with dysphagia: Australian standardised labels and definitions. *Nutrition and dietetics*. 2007;64(s2):S53–S76. Available from: https://doi.org/10.1111/j.1747-0080.2007.00153.x.

125) Diniz PB, Vanin G, Xavier R, Parente MA. Reduced incidence of aspiration with spoon-thick consistency in stroke patients. *Nutrition in Clinical Practice*. 2009;24(3):414–418. Available from: https://doi.org/10.1177/0884533608329440.

126) Whelan K. Inadequate fluid intakes in dysphagia acute stroke. *Clinical Nutrition*. 2001;20(5):423–428. Available from: https://www.clinicalnutritionjournal.com/article/S0261-5614(01)90467-4/abstract.

127) Vivanto AP, Campbell KL, Suter MS, Hannan-Jones MT, Hulcombe JA. Contribution of thickened drinks, food and enteral and parenteral fluids to fluid intake in hospitalised patients with dysphagia. *Journal of Human Nutrition and Dietetics*. 2009;22(2):148–155. Available from: https://doi.org/10.1111/j.1365-277x.2009.00944.x.

128) Kokura Y, Suzuki C, Wakabayashi H, Maeda K, Sakai K, Momosaki R. Semi-solid nutrients for prevention of enteral tube feeding-related complications in Japanese population: A systematic review and meta-analysis. *Nutrients*. 2020;12(6):1–14. Available from: https://doi.org/10.3390/nu12061687.

129) Wu XS, Miles A, Braakhuis A. Nutritional intake and meal composition of patients consuming texture modified diets and thickened fluids: a systematic review and meta-analysis. *Healthcare*. 2020;8(4):1–24. Available from: https://doi.org/10.3390/healthcare8040579.

130) Shen Z, Hou Y, Huerman A, Ma A. Patients with dysphagia: how to supply nutrition through non-tube feeding. *Frontiers in Nutrition*. 2022;9:1–11. Available from: https://doi.org/10.3389/fnut.2022.1060630.

131) Munialo CD, Kontogiorgos V, Euston SR, Nyambayo I. Rheological, tribological and sensory attributes of texture-modified foods for dysphagia patients and the elderly: A review. *International Journal of Food Science & Technology*. 2020;55(5):1862–1871. Available from: https://doi.org/10.1111/ijfs.14483.

132) Sukkar SG, Maggi N, Cupillo BT, Ruggiero C. Optimizing Texture Modified Foods for Oro-pharyngeal Dysphagia: A Difficult but Possible Target? *Frontiers in Nutrition*. 2018;5:1–10. Available from: https://doi.org/10.3389/fnut.2018.00068.

133) Martin A, Ortega O, Roca M, Arus M, Clavé P. Effect of a minimal-massive intervention in hospitalized older patients with oropharyngeal dysphagia: A proof of concept study. *The Journal of Nutrition, Health and Aging*. 2018;22(6):739–747. Available from: https://doi.org/10.1007/s12603-018-1043-3.

134) Reyes-Torres CA, Castillo-Martinez L, Guerrero RR, Ramos-Vazquez AG, Zavala-Solares M, et al. Design and implementation of modified-texture diet in older adults with oropharyngeal dysphagia: A randomized controlled trial. *European Journal of Clinical Nutrition*. 2019;73(7):989–996. Available from: https://doi.org/10.1038/s41430-019-0389-x.

135) Zanini M, Bagnasco A, Catania G, Aleo G, et al. A dedicated nutritional care program (NUTRICARE) to reduce malnutrition in institutionalised dysphagic older people: A quasi-experimental study. *Journal of Clinical Nursing*. 2017;26(23-24):4446–4455. Available from: https://doi.org/10.1111/jocn.13774.

136) Germain I, Dufresne T, Gray-Donald K. A novel dysphagia diet improves the nutrient intake of institutionalised elders. *Journal of the American Dietetic Association*. 2006;106(10):1614–1623. Available from: https://doi.org/10.1016/j.jada.2006.07.008.

137) Newman R, Vilardell N, Clave P, Speyer R. Effect of Bolus Viscosity on the Safety and Efficacy of Swallowing and the Kinematics of the Swallow Response in Patients with Oropharyngeal Dysphagia: White Paper by the European Society for Swallowing Disorders (ESSD). *Dysphagia*. 2016;31(2):232–249. Available from: https://doi.org/10.1007/s00455-016-9696-8.

138) Vilardell N, Rofes L, Arreola V, Speyer R, Clavé P. A comparative study between modified starch and xanthan gum thickeners in post-stroke oropharyngeal dysphagia. *Dysphagia*. 2016;31(2):169–179. Available from: https://doi.org/10.1007/s00455-015-9672-8.