



CANADIAN STROKE BEST PRACTICE RECOMMENDATIONS

Rehabilitation and Recovery following Stroke Evidence Tables ***Management of Dysphagia and Malnutrition*** ***Following Stroke***

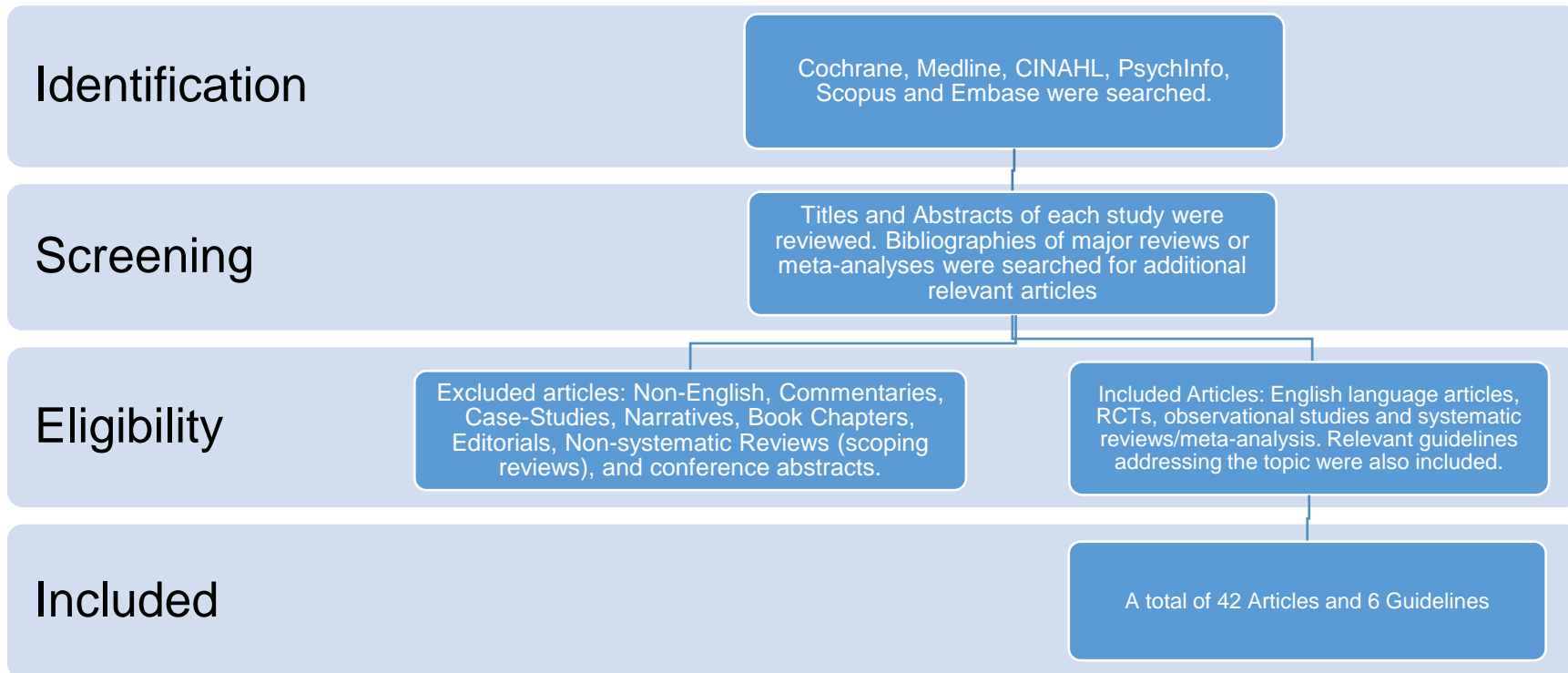
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STROKE REHABILITATION Writing Group

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Search Strategy



Cochrane, Medline, CINAHL, PsychInfo, Scopus and Embase were search using the terms “stroke” and “nutrition” or “dysphagia” or “oral hygiene” or mouth care”. Titles and abstract of each article were reviewed for relevance. Bibliographies were reviewed to find additional relevant articles. Articles were excluded if they were: non-English, commentaries, case-studies, narrative, book chapters, editorials, non-systematic review, or conference abstracts. Additional searches for relevant best practice guidelines were completed and included in a separate section of the review. A total of 42 articles and 6 guidelines were included and separated into categories designed to answer specific questions.

Published Guidelines

Guideline	Recommendations
<p>Powers WJ, Rabinstein AA, Ackerson T, Adeoye OM, Bambakidis NC, Becker K, Biller J, Brown M, Demaerschalk BM, Hoh B, Jauch EC, Kidwell CS, Leslie-Mazwi TM, Ovbiagele B, Scott PA, Sheth KN, Southerland AM, Summers DV, Tirschwell DL; on behalf of the American Heart Association Stroke Council.</p> <p>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.</p> <p><i>Stroke</i>. 2018; Mar;49(3):e46-e110</p>	<p>4.6. Dysphagia Screening</p> <ol style="list-style-type: none"> 1. Dysphagia screening before the patient begins eating, drinking, or receiving oral medications is reasonable to identify patients at increased risk for aspiration. Class IIa; LOE C-LD. 2. It is reasonable for dysphagia screening to be performed by a speech-language pathologist or other trained healthcare provider. Class IIa; C-LD. 3. An instrumental evaluation is reasonable for those patients suspected of aspiration to verify the presence/absence of aspiration and to determine the physiological reasons for the dysphagia to guide the treatment plan. Class IIa; LOE B-NR. 4. It is not well established which instrument to choose for evaluation of swallowing with sensory testing, but the choice may be based on instrument availability or other considerations (ie, fiberoptic endoscopic evaluation of swallowing, videofluoroscopy, fiberoptic endoscopic evaluation). Class IIb; LOE C-LD. <p>4.7. Nutrition</p> <ol style="list-style-type: none"> 1. Enteral diet should be started within 7 days of admission after an acute stroke. Class I; LOE B-R. 2. For patients with dysphagia, it is reasonable to initially use nasogastric tubes for feeding in the early phase of stroke (starting within the first 7 days) and to place percutaneous gastrostomy tubes in patients with longer anticipated persistent inability to swallow safely (>2–3 weeks). Class IIa; LOE C-EO. 3. Nutritional supplements are reasonable to consider for patients who are malnourished or at risk of malnourishment. Class IIa; LOE B-R. 4. Implementing oral hygiene protocols to reduce the risk of pneumonia after stroke may be reasonable. Class IIb; LOE B-NR.
<p>Clinical Guidelines for Stroke Management 2017. Melbourne (Australia): National Stroke Foundation.</p>	<p>Dysphagia Screening/Assessment</p> <p>People with acute stroke should have their swallowing screened within four hours of arrival at hospital and before being given any oral food, fluid or medication. Practice statement.</p> <p>People with acute stroke should have their swallowing screened, using a validated screening tool, by a trained healthcare professional. Weak recommendation</p> <p>All stroke patients who have failed swallow screening or who deteriorate should have a comprehensive assessment of swallowing performed by a speech pathologist. Weak recommendation</p> <p>Dysphagia Treatment</p> <p>For stroke survivors with swallowing difficulties, behavioural approaches such as swallowing exercises, environmental modifications, safe swallowing advice, and appropriate dietary modifications should be used early. Strong recommendation.</p> <p>For stroke survivors with dysphagia, non-invasive brain stimulation should only be provided within a research framework. Weak recommendation (against).</p> <p>For patients with stroke, acupuncture should not be used for treatment of dysphagia in routine practice other than as part of a research study. Weak recommendation (against).</p> <p>For stroke survivors with dysphagia, surface neuromuscular electrical stimulation should only be delivered by clinicians</p>

Guideline	Recommendations
	<p>experienced in this intervention and be applied according to published parameters in a research framework. Weak recommendation (against).</p> <p>For stroke survivors with dysphagia, pharyngeal electrical stimulation is not routinely recommended. Weak recommendation (against).</p> <p>Nutrition & Hydration All stroke patients should have their hydration status assessed, monitored, and managed throughout their hospital admission. Where fluid support is required, crystalloid solution should be used in preference to colloid solutions as the first option to treat or prevent dehydration. Strong recommendation.</p> <p>All stroke patients should be screened for malnutrition at admission and on an ongoing basis (at least weekly) while in hospital. Strong recommendation</p> <p>For stroke patients whose nutrition status is poor or deteriorating, nutrition supplementation should be offered. Strong recommendation.</p> <p>For stroke patients who do not recover a functional swallow, nasogastric tube feeding is the preferred method of feeding in the short term. Weak recommendation</p> <p>For stroke patients, there is no preference with regard to continuous pump (meaning using a pump for greater than or equal to 16hrs out of 24hrs for less than or equal to 80ml/hr) feeding versus intermittent bolus feeding (meaning 250-400mls/hr for 4- 5times/day) therefore practical issues, cost and patient preferences should guide practice. Weak recommendation</p> <p>For stroke patients who are adequately nourished, routine oral nutrition supplements are not recommended. Weak recommendation.</p> <p>Oral hygiene All stroke patients, particularly those with swallowing difficulties, should have assistance and/or education to maintain good oral and dental (including dentures) hygiene. Strong recommendation</p> <p>Staff and carers of stroke patients (in hospital, in residential care and home settings) should be trained in assessment and management of oral hygiene. Strong recommendation</p> <p>For stroke patients, chlorhexidine in combination with oral hygiene instruction, and/or assisted brushing may be used to decrease dental plaque and gingiva bleeding. Caution should be taken, however, for patients with dysphagia. Weak recommendation</p>
<p>Winstein CJ, Stein J, Arena R, Bates B, Cherney LR, Cramer SC, Deruyter F, Eng JJ, Fisher B, Harvey RL, Lang CE, MacKay-Lyons M, Ottenbacher KJ, Pugh S, Reeves MJ, Richards LG, Stiers W, Zorowitz RD; on behalf of the American</p>	<p>Dysphagia Early dysphagia screening is recommended for acute stroke patients to identify dysphagia or aspiration, which can lead to pneumonia, malnutrition, dehydration, and other complications. Class I, LOE B</p> <p>Dysphagia screening is reasonable by a speech-language pathologist or other trained healthcare provider. Class IIa, LOE C</p> <p>Assessment of swallowing before the patient begins eating, drinking, or receiving oral medications is recommended. Class I,</p>

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<p>Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, Council on Clinical Cardiology, and Council on Quality of Care and Outcomes Research.</p> <p>Guidelines for adult stroke rehabilitation and recovery: a guideline for healthcare professionals from the American Heart Association/American Stroke Association.</p> <p>Stroke 2016;47:e98–e169</p>	<p>LOE B</p> <p>An instrumental evaluation is probably indicated for those patients suspected of aspiration to verify the presence/absence of aspiration and to determine the physiological reasons for the dysphagia to guide the treatment plan. Class IIa, LOE B</p> <p>Selection of instrumental study (fiberoptic endoscopic evaluation of swallowing, videofluoroscopy, fiberoptic endoscopic evaluation of swallowing with sensory testing) may be based on availability or other considerations. Class IIb, LOE C</p> <p>Incorporating principles of neuroplasticity into dysphagia rehabilitation strategies/interventions is reasonable. Class IIa, LOE C</p> <p>Behavioral interventions may be considered as a component of dysphagia treatment. Class IIb LOE A</p> <p>Acupuncture may be considered as an adjunctive treatment for dysphagia. Class IIb, LOE B</p> <p>Drug therapy, NMES, pharyngeal electrical stimulation, physical stimulation, tDCS, and transcranial magnetic stimulation are of uncertain benefit and not currently recommended. Class III, LOE A</p> <p>Nutrition</p> <p>Enteral feedings (tube feedings) should be initiated within 7 days after stroke for patients who cannot safely swallow. Class I, LOE A</p> <p>Nasogastric tube feeding should be used for short term (2–3 weeks) nutritional support for patients who cannot swallow safely. Class I, LOE B</p> <p>Percutaneous gastrostomy tubes should be placed in patients with chronic inability to swallow safely. Class I, LOE B</p> <p>Nutritional supplements are reasonable to consider for patients who are malnourished or at risk of malnourishment. Class IIa, LOE B</p> <p>Oral Hygiene</p> <p>Oral hygiene protocols should be implemented to reduce the risk of aspiration pneumonia after stroke. Class I; LOE B.</p>
<p>National Clinical guidelines for stroke” 5th Edition 2016; Intercollegiate Stroke Working Party. Royal College of Physicians</p>	<p>4.16.1 People with acute stroke should have their swallowing screened, using a validated screening tool, by a trained healthcare professional within four hours of arrival at hospital and before being given any oral food, fluid or medication.</p> <p>Until a safe swallowing method is established, people with swallowing difficulty after acute stroke should: – be immediately considered for alternative fluids; – have a comprehensive specialist assessment of their swallowing; – be considered for nasogastric tube feeding within 24 hours; – be referred to a dietitian for specialist nutritional assessment, advice and monitoring; – receive adequate hydration, nutrition and medication by alternative means.</p> <p>Patients with swallowing difficulty after acute stroke should only be given food, fluids and medications in a form that can be swallowed without aspiration.</p> <p>People with stroke with suspected aspiration or who require tube feeding or dietary modification should be considered for</p>

Guideline	Recommendations
	<p>instrumental assessment (videofluoroscopy or fiberoptic endoscopic evaluation of swallowing).</p> <p>People with stroke who require instrumental assessment of swallowing (videofluoroscopy or fibre-optic endoscopic evaluation of swallowing) should only receive this: – in conjunction with a specialist in dysphagia management; – to investigate the nature and causes of aspiration; – to direct an active treatment/rehabilitation programme for swallowing difficulties.</p> <p>People with swallowing difficulty after stroke should be considered for swallowing rehabilitation by a specialist in dysphagia management. This should include one or more of: – compensatory strategies such as postural changes (e.g. chin tuck) or swallowing manoeuvres (e.g. supraglottic swallow); – restorative strategies to improve oropharyngeal motor function (e.g. Shaker headlifting exercises); – sensory modification, such as altering the taste and temperature of foods or carbonation of fluids; – texture modification of food and/or fluids.</p> <p>People with stroke who require modified food or fluid consistency should have these provided in line with nationally agreed descriptors.</p> <p>People with difficulties self-feeding after stroke should be assessed and provided with the appropriate equipment and assistance (including physical help and verbal encouragement) to promote independent and safe feeding.</p> <p>People with swallowing difficulty after stroke should be provided with written guidance for all staff/carers to use when feeding or providing fluids.</p> <p>People with stroke should be considered for gastrostomy feeding if they: – need but are unable to tolerate nasogastric tube feeding; – are unable to swallow adequate food and fluids orally by four weeks from the onset of stroke; – are at high long-term risk of malnutrition.</p> <p>People with stroke who are discharged from specialist treatment with continuing problems with swallowing food or fluids safely should be trained, or have family/carers trained, in the management of their swallowing difficulty and be regularly reassessed.</p> <p>People with stroke receiving end-of-life (palliative) care should not have burdensome restrictions imposed on oral food and/or fluid intake if those restrictions would exacerbate suffering.</p> <p>Mouth Care</p> <p>A People with stroke, especially those who have difficulty swallowing or are tube fed, should have mouth care at least 3 times a day including:</p> <ul style="list-style-type: none">– brushing of teeth and cleaning of gums with a suitable cleaning agent (toothpaste and/or chlorhexidine dental gel), for which an electric toothbrush should be considered;– removal of excess secretions;– application of lip balm. <p>B People with stroke who have dentures should have their dentures:</p> <ul style="list-style-type: none">– put in during the day;– cleaned regularly using a toothbrush, toothpaste and/or chlorhexidine dental gel;

Guideline	Recommendations
	<ul style="list-style-type: none"> - checked and replaced if ill-fitting, damaged or lost. <p>C People in hospital or living in a care home after stroke should receive mouth care from staff who have been trained in:</p> <ul style="list-style-type: none"> - assessment of oral hygiene; - selection and use of appropriate oral hygiene equipment and cleaning agents; - provision of oral care routines; - awareness and recognition of swallowing difficulties. <p>D People with stroke and their family/carers should receive information and training in mouth care and maintaining good oral hygiene before transfer of their care from hospital.</p>
<p>Scottish Intercollegiate Guidelines Network (SIGN). Management of patients with stroke: rehabilitation, prevention and management of complications, and discharge planning. A national clinical guideline. Edinburgh (Scotland): Scottish Intercollegiate Guidelines Network (SIGN); 2010 June. p.p. 26-28</p>	<p>Dysphagia Therapy All patients who have dysphagia for more than one week should be assessed to determine their suitability for a rehabilitative swallowing therapy programme. Consideration should be given to: the nature of the underlying swallowing impairment and the patient suitability in terms of motivation and cognitive status. (D)</p> <p>Patients with dysphagia should have an oropharyngeal swallowing rehabilitation programme that includes restorative exercises in addition to compensatory techniques and diet modification. (B)</p> <p>Nutrition Assessment Assessment of nutritional risk should be carried out within the first 48 hours with regular re-assessment thereafter during the patient's recovery and be recorded prior to discharge. (D)</p> <p>Assessment of a patient's nutritional risk should include an assessment of their ability to eat independently and a periodic record of their food consumption. (D)</p> <p>Ongoing monitoring of nutritional status after a stroke should include a combination of the following parameters: biochemical measures (ie low pre-albumin, impaired glucose metabolism), swallowing status, unintentional weight loss, eating assessment and dependence, nutritional intake. (D)</p> <p>Nutrition Interventions Following nutritional screening, those identified as undernourished, and those at risk of becoming undernourished, should be referred to a dietitian and considered for prescription of oral nutritional supplements as part of their overall nutritional care plan. (C)</p>
<p>Management of Stroke Rehabilitation Working Group. VA/DoD clinical practice guideline for the management of stroke rehabilitation. Washington (DC): Veterans Health Administration, Department of Defense; 2010. p.p.70-72</p>	<p>Dysphagia Management Patients with persistent dysphagia should be offered an individualized treatment program guided by a dynamic instrumental swallowing assessment. The treatment program may include: Modification of food texture and fluids to address swallowing on an individual basis, education regarding swallowing postures and maneuvers on an individual basis following instrumental assessment to verify the treatment effect, addressing appropriate method of medication administration for patients with evidence of pill dysphagia on clinical or instrumental assessment, training patients and care givers, in feeding techniques and the use of thickening agents, patients with chronic oropharyngeal dysphagia should be seen for regular reassessment to ensure effectiveness and appropriateness of long-standing diet, continued need for compensations, and/or modification of rehabilitative techniques. (No level of recommendation)</p> <p>Nutrition Management The nutritional and hydration status of stroke patients should be assessed within the first 48 hours of admission. (No level of recommendation)</p>

Guideline	Recommendations
	<p>recommendation)</p> <p>Stroke patients with suspected nutritional and/or hydration deficits, including dysphagia, should be referred to a dietitian. (No level of recommendation)</p> <p>Consider the use of feeding tubes to prevent or reverse the effects of malnutrition in patients who are unable to safely eat and those who may be unwilling to eat. (No level of recommendation)</p> <p>Oral supplementation may be considered for patients who are safe with oral intake, but do not receive sufficient quantities to meet their nutritional requirements. (No level of recommendation)</p>

Evidence Tables (Dysphagia)

Dysphagia Screening and Assessment

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
<p>Ho et al. 2018</p> <p>Taiwan</p> <p>Retrospective study</p>	NA	Patients included in a national database, ≥18 years who had been admitted from 2006-2010 for rehabilitation following first-ever stroke.	The outcomes of patients who had dysphagia (identified by the placement of ≥2 NG feeding tubes, n=5,032) were compared with those without dysphagia (n=52,323).	<p>Primary outcomes: Readmission to hospital within one year for chest infection (including pneumonia) and mortality at one-year post stroke</p> <p>Secondary outcomes: Same as primary, but assessed at 5 years</p>	<p>The mean NG tube insertions was 2.51 vs. 0.17 in the control group.</p> <p>One-year post stroke: The risks of chest infection and death were significantly higher among the patients with dysphagia (adjusted HR= 1.73, 95% CI 1.61-1.85 and HR=1.61, 95% CI 1.46-1.79, respectively).</p> <p>Five-years post stroke: The risks of chest infection and death were significantly higher among the patients with dysphagia (adjusted HR= 1.53, 95% CI 1.45-1.62 and HR=1.54, 95% CI 1.41-1.68, respectively).</p>
<p>Smith et al. 2018</p> <p>Canada/US/UK</p> <p>Systematic review</p>	NA	3 RCTs including persons ≥18 years, hospitalized for stroke (ischemic or hemorrhagic)	Trials compared dysphagia screening protocols or quality improvement interventions designed to improve screening rates vs. no screening, alternative screening, usual care or gold standard	<p>Primary outcomes: ≥1 of death, dependency, or pneumonia</p>	<p>3 trials (Rai et al. 2016, Miles et al. 2013 and Middleton et al. 2011), are all described below.</p> <p>The percentage of patients who received dysphagia screening and developed pneumonia was not significantly lower, compared with patients in a control group, in any of the trials.</p> <p>The authors highlight the lack of evidence from RCTs and state that “<i>no conclusions can be drawn about the clinical effectiveness of dysphagia screening protocols.</i>”</p>
<p>Bray et al. 2017</p> <p>UK</p> <p>Retrospective study</p>	NA	63,650 patients included in a nation register, ≥16 years admitted to 199 hospitals, following an acute ischaemic stroke or primary intracerebral haemorrhage, between 2013 and 2014. Median age was 77 years, 50.4% were female, 88.2% of strokes were ischemic	The risk of stroke-associated pneumonia in relation to timing of dysphagia screening and comprehensive assessment was examined using multivariable models adjusted for age, sex, stroke subtype, pre-stroke functional level	<p>Primary outcome: Stroke-associated pneumonia (SAP)</p> <p>Secondary outcome: 30-day mortality</p>	<p>55, 838 (87.7%) patients had a dysphagia screen, of which 24,542 (38.6%) proceeded to a comprehensive assessment by a SLP.</p> <p>The overall incidence of SAP was 8.7% (13.8% for patients not screened, 8.0% for patients who</p>

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			<p>(mRS), place of stroke (out of hospital vs. inpatient), vascular comorbidity and either NIHSS score or level of consciousness on admission. Timing of screening and assessment was arranged into quartiles.</p>		<p>were screened and 14.7% for patients who received a comprehensive assessment).</p> <p>The median time from admission to dysphagia screening was 2.9 hours.</p> <p>The median time from admission to dysphagia assessment was 22.9 hours.</p> <p>The odds of SAP associated with timing of screening including data from 55,838 patients were: Q1 (0-79 min): OR=1.00 (ref) Q2 (80-176 min): OR=0.92, 95% CI 0.83-1.01, p=0.08 Q3 (177-344 min): OR=0.89, 95% CI 0.81-0.99, p=0.03 Q4 (≥345 min): OR=1.14, 95% CI 1.03-1.24, p=0.008</p> <p>The odds of SAP associated with timing of dysphagia assessment including data from 24,542 patients were: Q1 (0-369 min): OR=1.00 (ref) Q2 (370-1371 min): OR=1.40, 95% CI 1.22-1.06, p<0.0001 Q3 (1372-2961 min): OR=1.60, 95% CI 1.41-1.84, p<0.0001 Q4 (≥2962 min): OR=2.01, 95% CI 1.76-2.30, p<0.0001</p> <p>The odds of 30-day mortality, excluding patients dying or who started palliative care in the first 72 hours after admission, were associated with increased delays in dysphagia assessment (Q1: ref, Q2 OR= 1.31, Q3 OR= 1.54, Q4OR=1.39, all p<0.0001)</p>

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<p>Joundi et al. 2017</p> <p>Canada</p> <p>Retrospective study</p>	NA	6,677 patients ≥18 years, included in the Canadian Stroke Registry from 2010-2013 who were eligible for dysphagia screening within 72 hours of admission following acute ischemic stroke. 78.7% of patients suffered a mild stroke (CNS score >7), 9.5% had moderately severe stroke (CNS 5-7) and 6.3% had a severe stroke (CNS <5)	The association between formal dysphagia outcome and stroke outcomes was examined.	<p>Primary outcome: In-hospital pneumonia within 30 days of admission, severe disability (mRS 4-5) and all-cause mortality at 1 year</p>	<p>19.2% of patients did not receive a dysphagia screen within 72 hours of admission.</p> <p>Independent predictors of receiving a dysphagia screen included older age, admission to specialized units, the presence of weakness, speech difficulties and treatment with thrombolysis.</p> <p>Patients with mild strokes were less likely to be screened compared with those with moderate strokes (adj OR=0.51, 95% CI 0.41-0.64).</p> <p>Of the patients who were screened, 47.8% failed. Compared with patients who passed the screen, those who failed were at significantly higher risk of pneumonia (adj OR=4.71, 95% CI 3.43-6.47), severe disability (adj OR=5.19, 95% CI 4.48-6.02) and death (adj OR=2.42, 95% CI 2.09-2.80)</p>
<p>Al-Khaled et al. 2016</p> <p>Germany</p> <p>Retrospective study</p>	NA	12,276 patients, ≥18 years recruited from 15 hospitals from 2007-2012 following admission for acute ischemic stroke. Mean age was 73 years, 49% were women.	The association between dysphagia, assessed shortly after admission to hospital, and clinical outcomes was examined.	<p>Primary outcomes: Stroke-related pneumonia during hospitalization</p> <p>Secondary outcomes: 30-day mortality, disability (mRS ≥2) at discharge and 30 days</p>	<p>9,164 patients were screened for dysphagia. 94% of patients were screened within 24 hours of admission. 3,083 patients had dysphagia.</p> <p>Mean LOS was 9 days. During this time, 1,271 patients (10.3%) developed pneumonia.</p> <p>Pneumonia incidence was significantly higher in patients with dysphagia (29.7% vs. 3.75, p<0.001).</p> <p>Dysphagia was an independent predictor of pneumonia (OR=3.4, 95% CI 2.8-4.2). Early dysphagia screening within 24 hours was protective (OR=0.68, 95% CI 0.52-0.89).</p> <p>Dysphagia was also a significant, independent predictor of case fatality (OR=2.8, 95% CI 2.1-3.7), disability at discharge (OR=2.0, 95% CI 1.6-2.3), 3-month mortality (OR=3.2, 95% CI 2.4-4.2) and 3-month disability (OR=2.3, 95% CI 1.8-3.0)</p>
<p>Rai et al. 2016</p>	CA: <input checked="" type="checkbox"/>	162 patients, ≥18 years admitted to 2 wards within	Patients were randomized by ward to	<p>Primary outcome: Aspiration pneumonia</p>	<p>Non-significantly fewer patients in the intervention group developed aspiration pneumonia during</p>

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
India Cluster RCT	Blinding: Patient <input checked="" type="checkbox"/> Assessor <input checked="" type="checkbox"/> ITT: <input checked="" type="checkbox"/>	72 hours of stroke onset. Mean age was 55.7 years, 73.5% were men. Median NIHSS score was 6	an intervention (n=77) or control group (n=85). Patients in the intervention group were managed by a stroke care pathway consisting of nurse education, care checklist, swallow assessment flowchart, swallow screen conducted by a physician, and patient and caregiver education. Patients in the control group were treated with conventional care. There was no dysphagia assessment, and feeding was started by the resident doctor based on clinical judgment.	Secondary outcomes: 3-month mortality, BI and mRS at 3 months	hospitalization (6.5% vs. 15.3%, RR = 0.42, 95% CI 0.16-1.14, $p=0.062$). Fewer patients in the intervention group required mechanical ventilation during hospital stay (7.8% vs. 17.6%, $p=0.05$). There were significantly fewer deaths in the intervention group at 90 days (7.8% vs. 20%, $p=0.02$). There were no significant differences between groups in median mRS or BI scores at discharge or 3 months.
Masrur et al. 2013 USA & Canada Retrospective study	NA	Records of 314,007 patients with ischemic stroke admitted to GWTG–Stroke hospitals between April 2003 and March 2009 were reviewed. Median age was 73 years, 48% male. Median NIHSS score was 4.	The outcomes of patients who had received a standardized swallowing screen by any method that was accepted by individual institutions (including bedside or instrumental methods) were compared with those of patients who had not been screened.	Primary outcome: The incidence of pneumonia occurring after 48 hours of admission.	216,372 (68.9%) patients were screened for dysphagia, 97,656 (31.1%) were not screened. 17,906 patients (5.7%) developed post-stroke pneumonia. Patients who were screened for dysphagia were more likely to develop pneumonia compared with those who did not develop pneumonia (7.5% vs. 68.5%, $p<0.001$). Significant predictors of whether a dysphagia screen was completed were: increasing age, increasing NIHSS score, admission to an academic hospital, atrial fibrillation and dyslipidemia.
Miles et al. 2013 New Zealand RCT	CA: <input checked="" type="checkbox"/> Blinding: Patient <input checked="" type="checkbox"/> Assessor <input checked="" type="checkbox"/>	311 patients, recruited from 4 hospitals who were referred to SLP following stroke for swallowing assessment. Mean age was	Patients were randomized to an experimental (n=149) or control group (n=163). Patients in the control	Primary outcome: Pneumonia at 3 months following recruitment Secondary outcome:	Within the experimental group, 61% of patients passed the CRT with a strong cough, 21% passed with a weak cough (21%) and 18% failed the test.

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
	ITT: <input checked="" type="checkbox"/>	78 years, 47% were men.	group were assessed using local protocols. Patients in the experimental group used a cough reflex test (CFT), using nebulized citric acid, delivered by face mask, prior to the standard assessment	3-month mortality	There were no significant differences between groups in the number of patients who developed pneumonia (experimental 26% vs. control 21%, p=0.38), or who were dead at 3 months (experimental 20% vs. control 14%, p=0.23).
Middleton et al. 2011 Australia Cluster RCT Quality in Acute Stroke Care (QASC)	CA: <input checked="" type="checkbox"/> Blinding: Patient <input checked="" type="checkbox"/> Assessor <input checked="" type="checkbox"/> ITT: <input checked="" type="checkbox"/>	19 large tertiary care facilities with acute stroke units. Patients were eligible if they had been admitted to one of these facilities with a diagnosis of stroke (ischemic or hemorrhagic) within 48 hours. Age was evenly distributed among 3 groups, age 65 to 85. 60% male. 41% mild stroke.	4,198 patients were randomized to receive care at institutions that had adopted nursing protocols to identify and manage 3 complications-hyperglycemia, fever and swallowing dysfunction or to a control facility. Clinicians at the participating control institutions received abridged guidelines only. The dysphagia component included education and training in the use of the ASSIST screening tool. Nurses were required to pass a clinical competency tests prior to conducting swallowing screening. Patients who failed the screen were referred to an SLP for assessment.	Primary outcome: Death or dependency at 90 days (mRS score of ≥ 2), BI, SF-36 (mental component summary score), physical component summary score Secondary outcomes: Mean temperature for first 72 hours, proportion of swallowing screenings completed within the first 24 hours of admission, pneumonia diagnosis, LOS	Intervention was associated with a decreased frequency of death or dependency at 90 days (42% vs. 58%, p=0.002). The % of patients with BI scores ≥ 95 was non-significantly higher in the intervention group (69% vs. 60%, p=0.07). Dysphagia outcomes: Swallowing screening was performed more frequently in the intervention group (46% vs. 7%, p<0.0001). There was no difference between groups in the incidence of pneumonia (2% vs. 3%, p=0.82).
Lakshminarayan et al. 2010 USA Audit of National Stroke	NA	Records of 18,017 patients admitted and discharged for stroke from 222 hospitals in 6 states from March 1 to Dec 31, 2009, were reviewed.	Patients were identified and classified according to dysphagia screening status: Unscreened Screen/pass Screen/fail	Primary outcome: Pneumonia	Number (%) of patients: Unscreened: 4509 (25%) Screened/pass: 8406 (46.6%) Screened/fail: 5099 (28.3%) Adjusting for age, gender, race, weakness, aphasia and altered level of consciousness,

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Registry			Association's between screening status and incidence of pneumonia were explored using adjusted logistic regression		unscreened patients were at higher risk of developing pneumonia compared to patients who passed screening (OR=2.2, 95% CI 1.7 to 2.7).
Hinchey et al. 2005 USA Uncontrolled study	NA	15 institutions in the US (73% with dedicated stroke units) collected data prospectively on patients discharged with a diagnosis of ischemic stroke.	Adherence rates between sites with formal dysphagia screening protocols and those without formal protocols were examined for differences in pneumonia rates	Outcomes: Adherence rates to dysphagia screening development of pneumonia, mortality	6 of the 15 sites had formal dysphagia screening protocols Screens were conducted more frequently at sites with a formal screening protocol (78% vs. 56%, p<0.0001. Pneumonia occurred less frequently at sites with formal screening protocols (2.4% vs. 5.4%). Mortality was higher among patients who developed pneumonia (21% vs. 4.8%, p<0.0001).

Dysphagia Treatment

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
<i>Overview</i>					
Bath et al. 2018 UK Cochrane review	The quality of the evidence was generally very low, low, or moderate	41 RCTs (2,660) including persons with post stroke dysphagia within 6 months of onset.	Treatment interventions included acupuncture (11 studies), behavioural interventions (9 studies), drug therapy (3 studies), neuromuscular electrical stimulation (NMES; 6 studies), pharyngeal electrical stimulation (PES; 4 studies), physical stimulation (3 studies), transcranial direct current stimulation (tDCS; 2 studies), and transcranial magnetic stimulation (TMS; 9 studies).	Primary outcome: Death or dependency Secondary outcomes: Case fatality at the end of the trial, length of inpatient stay (LOS), proportion of participants with dysphagia at the end of the trial, swallowing ability, penetration aspiration score, chest infection or pneumonia, pharyngeal transit time, institutionalization, and nutrition.	Based on the results of a single trial, swallowing therapy (behavioral intervention) did not decrease the odds of the primary outcome (OR=1.05, 95% CI 0.63 to 1.75; 306 participants). Swallowing therapy (behavioral interventions, drug therapy, PES, physical stimulation, TMS) did not reduce the odds of case fatality at end-of-trial (OR=1.00; 95% CI, 0.66–1.52; n=766; 14 studies). Swallowing therapy (behavioral interventions, PES) significantly reduced mean LOS (MD -2.9, 95% CI -5.65 to -0.15; 577 participants; 8 studies). Swallowing therapy (acupuncture, behavioral interventions, drug therapy, NMES, PES, physical

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					<p>stimulation, tDCS) significantly reduced the proportion of participants with dysphagia at the end of the trial (OR= 0.42, 95% CI 0.32 to 0.55; 1487 participants; 23 studies).</p> <p>Swallowing therapy (behavioral intervention, PES, NMES, TMS) did not reduce the mean penetration aspiration score, identified on radiological examination (SMD -0.37, 95% CI -0.74 to -0.00; 303 participants; 11 studies).</p> <p>Swallowing therapy (behavioral interventions, drug therapy, NMES, PES) significantly reduced the incidence of chest infection or pneumonia (OR 0.36, 95% CI 0.16 to 0.78; 618 participants; 9 studies).</p>
<p>Geeganage et al. 2012</p> <p>UK</p> <p>Cochrane review</p>	NA	33 RCTs (6,779 subjects) examining a variety of interventions associated with dysphagia and nutrition provided within the first 6 months of stroke onset.	<p>Treatment interventions examined included: acupuncture (5 RCTs), behavioral interventions (5 RCTs), drug therapy (2 RCTs), neuromuscular electrical stimulation (NMES) (1 RCT), pharyngeal electrical stimulation (PES) (1 RCT), physical stimulation (thermal, tactile) (2 RCTs), transcranial direct current stimulation (tDCS) (1 RCT), repetitive transcranial magnetic stimulation (rTMS)(1 RCT).</p> <p>Nutrition Interventions and results reported in nutrition section (below</p>	<p>Primary outcome: Case fatality at end of trial, death or dependency, need for institutionalization</p> <p>Secondary outcomes: LOS, chest infection or pneumonia, proportion with dysphagia at the end of the trial, improvement in dysphagia, gastrointestinal bleeding, feeding tube failures, pressure sores.</p>	<p>There were no reductions in the odds of case fatality at the end of the trial associated with dysphagia therapies. The results from 6 trials were included.</p> <p>There were no reductions in the odds of death or dependency, or the need for institutionalization at the end of the trial associated with dysphagia therapies. The results from a single trial with 3 treatment arms were included.</p> <p>There was no significant decrease in mean LOS associated with dysphagia therapies (MD=-2.70, 95% CI -5.68 to 0.28. p=0.076. Results from 4 trials included.)</p> <p>There was no reduction in the risks of chest infections or pneumonia associated with behavioral interventions, drug therapy, or electrical stimulation.</p> <p>Acupuncture and behavioral interventions were associated with significant reductions in odds of dysphagia at the end of treatment (OR= 0.24, 95% CI 0.13 to 0.46; p < 0.0001, results from 4 trials included and OR=0.52, 95% CI 0.30 to 0.88; p = 0.01, results from 5 trials included, respectively).</p>
<i>Pharyngeal Electrical Stimulation</i>					
Bath et al. 2016	CA: <input checked="" type="checkbox"/>	162 patients, recruited	Patients were	Primary outcome:	Mean baseline PAS were 4.8 (PES) and 4.7 (sham).

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<p>UK</p> <p>RCT</p> <p>Swallowing Treatment Using Pharyngeal Electrical Stimulation (STEPS) Trial</p>	<p>Blinding: Patient <input checked="" type="checkbox"/> Assessor <input checked="" type="checkbox"/></p> <p>ITT: <input checked="" type="checkbox"/></p>	<p>from 20 sites, ≥18 years, with a recent ischemic or hemorrhagic stroke and dysphagia, defined as a penetration aspiration score (PAS) of ≥3, who could be treated within 42 days of stroke onset. Patients with a history of dysphagia, were excluded. Mean age was 74 years, 58% were men. The mean time from stroke onset to randomization was 13 days. Mean Barthel Index score was 28.4.</p>	<p>randomized to receive 3 days of pharyngeal electrical stimulation (PES, n=87) or sham stimulation (n=75). Patients in the PES group received treatment for 10 minutes at a treatment current of threshold plus 75% of the difference between threshold and tolerance levels. Patients in the sham group received no stimulation after establishment of threshold and tolerated levels</p>	<p>Penetration Aspiration Score (PAS) at 2 weeks</p> <p>Secondary outcomes: PAS at 12 weeks, Dysphagia Severity Rating Scale (DSRS), mRS, Barthel Index and death, assessed at 2 and 12 weeks</p>	<p>The mean treatment stimulation level was 14.5 mA.</p> <p>141 patients received at least one treatment session. 58% of PES-treated patients had a treatment level <10.2 mA (i.e sub-therapeutic)</p> <p>At the end of the treatment period there was no significant between group difference in mean of 8 boli PAS (3.7 vs. 3.6, p=0.86). There were no interactions noted in subgroup analyses (age, sex, time from stroke onset, stroke type and severity, dysphagia severity or treatment intensity)</p> <p>There was no significant difference between groups in the percentage of patients with any PAS >3 on any of the 8 test boli (85.7% vs. 80.4%, p=0.79).</p> <p>There was no significant difference between groups in mean PAS at 12 weeks (average of all 8 test boli) 3.3 vs. 3.0, p=0.41.</p> <p>There were no significant differences between groups on any of the secondary outcomes.</p> <p>There were no serious adverse events recorded as probably or possibly related to treatment.</p>
<p>Vasant et al. 2016</p> <p>UK</p> <p>RCT</p>	<p>CA: <input checked="" type="checkbox"/></p> <p>Blinding: Patient <input checked="" type="checkbox"/> Assessor <input checked="" type="checkbox"/></p> <p>ITT: <input checked="" type="checkbox"/></p>	<p>36 patients, recruited from 3 hospitals with new onset dysphagia following stroke occurring within the previous 6 weeks. Eligible patients were screened using the TOR-BSST. Patients who failed the screen were then identified as dysphagic using either VFS exam or FEES. Median age was 71 years, 61% were men. Median time from stroke onset to randomization</p>	<p>Patients were randomized to receive 3 consecutive days of pharyngeal electrical stimulation (PES, n=18) or sham stimulation (n=18). Patients in the PES group received treatment for 10 minutes at a treatment current of 75% of the maximum level tolerated. Patients in the sham group received no stimulation. Patients in both groups received</p>	<p>Primary outcome: Presence of no/mild dysphagia (DSR of 0-3) at 2 weeks.</p> <p>Secondary Outcomes: As per primary outcome, assessed at 3 months, time from randomization to hospital discharge, time from randomization to removal of feeding tube, Penetration Aspiration Scale (PAS) ≥3</p>	<p>Mean stimulation intensities were 19.9 mA (day 1), 18.1 mA (day 2) and 12.5 mA (day 3)</p> <p>At 2 weeks, there was no significant difference between groups in the proportion of patients with no or mild dysphagia (11 patients (61%) in the active treatment group vs. 9 patients (50%) in the sham group, OR=2.5, 95% CI 0.52-14, p=0.26).</p> <p>At 3 months there was no significant difference between groups in the proportion of patients with no or mild dysphagia (14 patients (78%) in the active treatment group vs. 13 patients (76%) in the sham group, OR=0.97, 95% CI 0.13-7, p=0.97).</p> <p>The median times from randomization until hospital</p>

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		was 13 days. Median baseline Dysphagia Severity Rating Scale (DSR) score was 8.0	standard dysphagia therapy by a SLP.		discharge were not significantly different (39 days in active vs. 52 days in sham groups, p=0.62). Median time to NG tube removal was 8 days in active vs. 14 days in sham group, (p=0.33).
Scutt et al. 2015 UK Patient-level meta-analysis	NA	3 RCTs (n=72) including adults recovering from ischaemic or hemorrhagic stroke within 90 days of onset. Mean age was 72 years, 62% were men. Mean baseline NIHSS score was 10.6. Mean time from stroke onset to randomization was 15 days.	Treatment contrast was pharyngeal electrical stimulation versus control (sham or open-label) treatment	Primary outcomes: Aspiration, defined as a score of >3 using the Penetration Aspiration Score (PAS) at 2 weeks and clinical dysphagia severity, defined as a score of >3, using the Dysphagia Severity Rating Scale (DSRS) Secondary outcomes: NIHSS score, pneumonia, LOS and death	The mean threshold sensitivity was 11.4 mA and treatment level was 16.8 mA. Using the mean of the first three boli, the mean PAS score was significantly lower in the active PAS group (3.4 vs. 4.1). In a model adjusting for trial, relevant baseline score, age, and NIHSS, the difference in the OR between groups was -0.9, 95% CI -1.7 to -0.1, p=0.02. In subgroup analysis, treatment was more effective in patients with more severe strokes (NIHSS >10 vs. ≤10 and for those with more severe dysphagia (PAS .4 vs. ≤4). Treatment was also more effective for patients sensitive to low stimulation currents (<8mA). A significantly lower percentage of participants in the active PAS group had a DSRS score >3 (30.3% vs. 53.3%, p=0.032), and had lower mean DSRS scores (3.8 vs. 4.4, p=0.04). There were no significant differences between groups for any of the secondary outcomes.
<i>Neuromuscular Electrical Stimulation</i>					
Park et al. 2016 South Korea RCT	CA: <input checked="" type="checkbox"/> Blinding: Patient <input checked="" type="checkbox"/> Assessor <input checked="" type="checkbox"/> ITT: <input checked="" type="checkbox"/>	61 patients recruited from a rehabilitation hospital with VFS confirmed dysphagia following a stroke occurring within the previous 6 months, who were able to swallow against the resistance applied by using electrical stimulation. Mean age was 54.5 years, 52% were men. Mean time from stroke onset to randomization	Patients were randomized to receive 6 weeks of sham or active NMES using the VitalStim device for 30 minutes, 5x/week. Patients in both groups received conventional dysphagia treatment. In the experimental group, the electrical stimulation was applied to induce a strong muscle contraction, while in the control group, the	Primary outcomes: Videofluoroscopy Dysphagia Scale (VDS) and Penetration–Aspiration Scale (PAS), assessed before and after treatment. Secondary Outcomes: Hyoid bone movement	The mean stimulation intensity was 13.2 mA. Mean total VDS scores improved significantly over the treatment period (active 59.3 to 45.1, p<0.0001 and control 59.5 to 57.4, p=0.02). The improvement was significantly greater in the active group (mean change =14.1 vs. 2.1, p<0.001). Mean total PAS scores improved significantly over the treatment period in the active treatment group (4.96 to 3.60, p<0.001) but not in the control group (4.72 to 4.52, p=0.06). The improvement was significantly greater in the active group (mean change =1.36 vs. 0.2, p<0.001).

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		was 35.5 weeks.	minimum stimulation that was needed for the patient to feel a tingling sensation, was applied. Patients performed an effortful swallow with their saliva or a small bolus during the stimulation to elevate the hyoid bone.		There was significant improvement in mean horizontal and vertical displacement (cm) of the hyoid bone for patients in the active treatment group, but not the control group. There were 11 losses to follow-up.
Terre & Mearin 2015 Spain RCT	CA: <input checked="" type="checkbox"/> Blinding: Patient <input checked="" type="checkbox"/> Assessor <input checked="" type="checkbox"/> ITT: <input checked="" type="checkbox"/>	20 patients ≥18 years, with VFS-confirmed aspiration following either stroke (n=14) or TBI (n=6) occurring within the previous 6 months, who were able to understand and follow verbal commands. Median age was 49 years, 60% were men. At baseline, 15 patients were NPO.	Patients were randomized to receive 6 sessions over 4 weeks of sham (n=10) or active NMES using the VitalStim device (n=10) in addition to conventional swallowing therapy (modified diet and exercises to improve motor function). Maximum stimulation level for patients in the active treatment group was 25.0 mA. Sessions lasted 60 minutes.	Primary outcome: Functional Oral Intake Scale (FOIS), assessed at baseline, after treatment and at 3 months. Secondary outcomes: Patient-perceived improvement (7-point Likert scale), oral transit time (OTT), pharyngeal delay time (PDT) and pharyngeal transit time (PTT)	Mean stimulation intensity for patients in the active treatment group was 9.5 mA. Patients in both groups improved over time. The improvement in mean FOIS score was significantly greater in the active treatment group at 4 weeks (1.9 to 4.9 vs 2.1 to 3.1, p<0.005), but not at 3 months (5.3 vs. 4.6, p>0.05). A significantly higher proportion of patients in the active treatment group considered themselves to be much better at 4 weeks (6 vs. 0), but not at 3 months (4 vs. 3). There were improvements in temporal measurements of oropharyngeal function in both groups (mean OTT, PDT and PTT), but no significant differences between groups. At 3 months 6 patients in the active treatment group had resumed a normal diet with no restrictions, compared with 4 patients in the sham group.
Lim et al. 2014 Korea RCT	CA: <input checked="" type="checkbox"/> Blinding: Patient <input checked="" type="checkbox"/> Assessor <input checked="" type="checkbox"/> ITT: <input checked="" type="checkbox"/>	60 patients ≥18 years, with VFS-confirmed dysphagia following unilateral stroke occurring within the previous 6 months, who were able to understand and follow verbal commands. Mean age was 63 years, 57% were men. Mean NIHSS score	Patients were randomly assigned 1:1:1 to one of 3 groups: 1) conventional swallowing therapy group (muscle-strengthening, exercise for range of motion of the neck and tongue, thermal tactile stimulation and Mendelson maneuver), 2) NMES using the	Primary outcome: Functional Dysphagia Scale (FDS) Secondary outcomes: pharyngeal transit time (PTT), Penetration Aspiration Scale (PAS), American Speech-Language Hearing Association National Outcomes Measurement	Mean time from stroke onset to randomization was 34.5 days. There was improvement in mean FDS and PAS scores in all groups over time. The difference in mean scores from baseline to 2 weeks and baseline to 4 weeks did not differ between groups using a semi-solid test bolus, but mean scores were significantly more improved in both the rTMS and NMES groups at both 2 and 4 weeks using a liquid test bolus, compared with conventional therapy

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		was 8.5	VitalStim for 30 minutes, 5x/week x 2 weeks + conventional therapy or 3) rTMS, delivered for 20 minutes (total 1,200 pulses a day), 5x/week x 2 weeks + conventional therapy.	System (ASHA NOMS) Assessments were conducted at baseline, and at 2 and 4 weeks	group for both outcomes. There was significant improvement in mean PTT (semi-solid and liquid boli) and ASHA NOMS scores among the 3 groups, but no significant differences in mean changes between groups. There were 11 drop outs.
Xia et al. 2011 China RCT	CA: ☒ Blinding: Patient ☒ Assessor ☒ ITT: ☒	120 patients with post-stroke dysphagia (mean duration of 9 days) admitted to either the rehabilitation or neurology departments of a hospital.	Patients were randomly assigned to one of 3 groups: 1) conventional swallowing therapy group, 2) electrical stimulation (ES) with the VitalStim therapy group, and 3) VitalStim therapy plus conventional swallowing therapy group. Treatments with ES were given twice a day for 230 min each, 5 days a week for 4 weeks.	Primary outcome: Standardized Swallowing Assessment (SSA) Secondary outcomes: Dysphagia Severity Scale assessed using VMBS, Swallowing-related Quality of Life (SWAL-QoL) (44 items, higher scores indicate improvement) Assessments were conducted before and after treatment.	Mean±sd scores of groups 1, 2, 3 before and after treatment SSA: 40.9±6.4 to 30.1±3.8 vs. 38.7±6.9 to 29.6±4.2 vs. 39.5±7.1 to 24.1±3.5 There were significant differences in scores between: groups 1 vs. 3 and 2 vs. 3 Dysphagia Severity Scale: 2.74±1.63 to 5.32±1.43 vs. 2.65±1.56 to 5.63±1.57 vs. 2.53±1.58 to 6.88±1.58 There were significant differences in scores between: groups 1 vs. 3 and 2 vs. 3 SWAL-QoL: 863±83 to 624±45 vs. 850±75 to 645±58 vs. 885±60 to 458±35 There were significant differences in scores between: groups 1 vs. 3 and 2 vs. 3 Drop-outs: None
Lim et al. 2009 Korea RCT	CA: ☒ Blinding: Patient ☒ Assessor ☒ ITT: ☒	36 patients with post-stroke dysphagia admitted to a rehabilitation hospital. Mean age was 65 years 67% were men. 22 patients (61%) had stroke onset within the previous 6 months.	Patients were randomized to receive treatment with NMES using the VitalStim device + thermal tactile stimulation (TTS, n=16) or TTS only (n=12) for 4 weeks. NMES treatment was delivered at an intensity	Primary Outcomes: Swallowing Function Scoring System (FSS), Penetration Aspiration Scale (PAS) and pharyngeal transit time (sec) (PTT) Assessments were conducted before and after treatment	The median FSS improved significantly from 2 to 4 in the NMES+TTS group (p<0.05) and from 3 to 4 in the TTS group (p>0.05) The difference in median change scores was significant (p<0.05). The improvement in median PAS (semi-solid foods) was greater in the NMES+TTS group (5.5 to 2.5 vs. 3.5 to 4, p<0.05), as was improvement using liquid test boli (7 to 5 vs. 7 to 6.5, p<0.05). The mean PTT (semi-solid) from baseline to end of

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			of 7mA. Therapy sessions lasted for 1 hour and were provided 5 days a week. The TTS used was ice, rubbed on the faucial pillars using a standardized procedure. 5 trials were performed each week.		<p>treatment was: NMES + TTS 0.97 to 0.86 sec, mean difference=0.11, p<0.05 TTS 0.97 to 0.96 sec, mean difference=0.01, p>0.05 The improvement in the NMES+TTS group was significantly greater (p<0.05).</p> <p>The mean PTT (liquid) from baseline to end of treatment was: NMES + TTS 0.96 to 0.86 sec, mean difference=0.10, p<0.05 TTS 0.99 to 0.97 sec, mean difference=0.02, p<0.05. The improvement in the NMES+TTS group was significantly greater (p<0.05)</p> <p>There were 8 dropouts</p>
Carnaby-Mann & Crary 2007 USA Systematic review & meta-analysis	NA	7 studies (1 controlled, 6 uncontrolled, n=255 patients) with oropharyngeal dysphagia secondary to stroke, cancer or other disease, without consideration to the timing of treatment intervention or the onset of dysphagia.	All studies evaluated treatment with NMES applied to the throat for swallowing rehabilitation + standard therapy. Treatment was provided daily for 1 hour in most studies, for a duration of 1 to 24 weeks.	Primary outcome: Treatment effect size	<p>Cumulative SMD (Hedge's g) =0.66, 95% CI 0.47 to 0.85, p<0.001).</p> <p>One controlled trial included participants exclusively with stroke (n=110)</p>
<i>Non-invasive Brain Stimulation</i>					
Suntrup-Krueger et al. 2018 Germany RCT	CA: <input checked="" type="checkbox"/> Blinding: Patient <input checked="" type="checkbox"/> Assessor <input checked="" type="checkbox"/> ITT: <input checked="" type="checkbox"/>	60 patients ≥ 18 years diagnosed with dysphagia resulting from acute ischemic stroke. Mean age was 67.5 years, 58% were men. Mean NIHSS score at admission was 12.	Patients were randomized 1:1 to receive contralesional anodal tDCS (1mA) or sham stimulation over the contralesional swallowing motor cortex for 20 minutes, once daily for 4 consecutive days.	Primary outcome: Improvement in Fiberoptic Endoscopic Dysphagia Severity Scale (FEDSS) scores Secondary outcomes: Dysphagia Severity Rating Scale (DSRS), dysphagia limit (the amount of water that could be swallowed without piecemeal deglutition or clinical signs of aspiration)	<p>Mean time from stroke onset to study inclusion was 4.8 days.</p> <p>Mean FEDSS scores improved significantly from baseline to post intervention (active tDCS group: p < 0.001 and sham group: p = 0.027) and from then to discharge within both groups.</p> <p>At the end of treatment there was significantly greater improvement in mean FEDSS and DSRS scores in the active stimulation group (-1.3 vs. -0.4, p=0.005, and -4.0 vs. -1.5, p<0.001, respectively). The improvements were maintained until discharge.</p>

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					<p>At the end of treatment there was significantly greater improvement in dysphagia limit in the active stimulation group (mean 5.0 vs. 1.8 mL fluid, p=0.018).</p> <p>The incidence of pneumonia was non-significantly lower in the active stimulation group (37.9% vs. 53.3%, p=0.235).</p>
<p>Du et al. 2016</p> <p>China</p> <p>RCT</p>	<p>CA: <input checked="" type="checkbox"/></p> <p>Blinding: Patient <input checked="" type="checkbox"/> Assessor <input checked="" type="checkbox"/></p> <p>ITT: <input checked="" type="checkbox"/></p>	<p>40 patients with dysphagia secondary to first-ever hemispheric ischemic stroke, recruited from a single institution from 2013-2014, with onset of symptoms within 2 months. Mean age was 58 years, mean time from stroke to recruitment was 7 days.</p>	<p>Patients were randomized to receive high-frequency (3-Hz), low-frequency (1-Hz), or sham (control) rTMS for 5 consecutive days.</p>	<p>Primary outcome: Standardized Swallowing Assessment (SSA) at 3 months</p> <p>Secondary outcomes: mRS score, Barthel Index</p> <p>Assessments were conducted at baseline, day 5, 1, 2 and 3 months</p>	<p>There was significant improvement in the SSA scores at 3 months for patients in both rTMS groups, which was maintained over time, but not for patients in the control group.</p> <p>There was significantly greater improvement in mean mRS and median BI scores over at 3 months for patients in both rTMS groups, but not for patients in the control group.</p>
<p>Shigematsu et al. 2013</p> <p>Japan</p> <p>RCT</p>	<p>CA: <input checked="" type="checkbox"/></p> <p>Blinding: Patient <input checked="" type="checkbox"/> Assessor <input checked="" type="checkbox"/></p> <p>ITT: <input checked="" type="checkbox"/></p>	<p>20 patients, recruited from a single rehabilitation facility at least 4 weeks from stroke onset, with chronic, severe dysphagia. Mean age was 65.8 years, 65%</p>	<p>Patients were randomized to receive real (n=10) or sham (n=10) anodal tDCS for 10 days. In the real tDCS group, the stimulation level was 1-mA, treatment was provided for 20 minutes. Electrodes were placed over the ipsilesional hemisphere, at the location of the pharyngeal motor cortex. Patients in both groups also received conventional swallowing therapy.</p>	<p>Primary outcome: Dysphagic Outcome and Severity Scale (DOSS), assessed before and after treatment and at 1-month post treatment</p>	<p>Mean duration from stroke onset to initiation of treatment was 12 weeks.</p> <p>Mean admission FIM score was 34.1.</p> <p>Mean DOSS scores improved significantly over time in the real tDCS group (1.9 ± 0.7 to 3.3 ± 1.3, post treatment, (mean change =1.4, p=0.006) to 4.7 ± 0.9, at one month (mean change from baseline=2.8, p=0.004).</p> <p>In the sham tDCS group, mean DOSS score increased non-significantly from 2.3 ± 1.0 to 2.8 ± 1.0, post treatment (mean change from baseline=0.5, p=0.059), but the increase at 1-month post treatment was significant (3.5 ± 0.9, mean change=1.2, p=0.026).</p> <p>The differences in mean scores post treatment and at one-month post treatment between groups were significant (p= p=0.029 and p=0.007, respectively).</p> <p>Before therapy, 2 patients in the real tDCS group</p>

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Park et al. 2013 South Korea RCT	CA: <input checked="" type="checkbox"/> Blinding: Patient <input checked="" type="checkbox"/> Assessor <input checked="" type="checkbox"/> ITT: <input checked="" type="checkbox"/>	18 patients with unilateral hemispheric stroke and oropharyngeal dysphagia confirmed by VFS examination, lasting more than one month. Mean age was 71.3 years, 56% were men.	Patients were randomized to receive 10 days of real (n=9) or sham rTMS (n=9). In the real rTMS group, stimulation was applied for 10 min every day (5-Hz stimulation, 10 blocks of 50 pulses), with coil positioned over esophageal area of the affected hemisphere.	Primary outcomes: Videofluoroscopic dysphagia scale (VDS) and Penetration- aspiration scale (PAS) scores. Outcomes were assessed before and after the intervention and at 2 weeks follow-up.	and 3 in the sham group were fed PO exclusively. After treatment, all patients in the real tDCS group and 2 in the sham group were taking an oral diet exclusively. Mean duration from stroke onset to initiation of treatment was 62 days. Mean BI score was 34.5. Mean VDS score in the real rTMS group was reduced significantly from baseline to post-intervention (33.6 to 25.3, p<0.05). The improvement was maintained at 2-week follow-up. The improvement was most pronounced in the pharyngeal phase, compared with oral phase). Mean VDS score in the sham rTMS group did not improve significantly over the study period (baseline 23.4, post treatment 21.2, 2-week follow-up 20.4, p>0.05) Mean PAS scores were reduced significantly among patients in the real rTMS group over the study period (3.41 to 1.93 to 1.37, p<0.05), but were not among patients in the sham group (3.30 to 3.00 to 3.11, p>0.05). Baseline prevalences of aspiration, pharyngeal residue, delayed triggering of pharyngeal swallowing and abnormal pharyngeal transit time (PTT) in EG were 66.7%, 66.7%, 33.3%, and 44.4%, respectively. After rTMS, the prevalences of aspiration and pharyngeal residue were both reduced to 33.3%. However, the prevalence of delayed triggering and abnormal PTT was not changed.
Khedr et al. 2009 Egypt	CA: <input checked="" type="checkbox"/> Blinding: Patient <input checked="" type="checkbox"/> Assessor <input checked="" type="checkbox"/>	26 patients with clinically-assessed dysphagia following acute (5-10 days) MCA infarct. Mean age was 57.3 years, 38%	Patients were randomized to receive 5 days of real (n=14) or sham (n=12) rTMS. In the real rTMS group,	Primary outcome: Dysphagic Outcome and Severity Scale (DOSS) Secondary Outcomes:	Mean DOSS scores improved over time for patients in both groups, but improvement was significantly greater in the active rTMS group. There were improvements over time in grip force

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RCT	ITT: <input checked="" type="checkbox"/>	were men.	stimulation was applied for 10 min every day (10 trains of 3-Hz stimulation, each lasting for 10 seconds and then repeated every minute with coil positioned over esophageal cortical area of the affected hemisphere.	BI, hand grip force Assessments were completed before and after treatment and at 1 and 2 months	and BI scores. Improvement in mean BI score was significantly greater for patients in the real rTMS group. There was a single drop-out (death)
<i>Behavioral intervention</i>					
Carnaby et al. 2006 USA RCT	CA: <input checked="" type="checkbox"/> Blinding: Patient <input checked="" type="checkbox"/> Assessor <input checked="" type="checkbox"/> ITT: <input checked="" type="checkbox"/>	306 patients with clinically identified dysphagia admitted to hospital within 7 days of acute stroke, with no previous history of dysphagia. Mean age was 71 years, 58% were men.	Patients were randomly assigned to receive usual care (supervision for feeding and precautions for safe swallowing; n=102), standard low-intensity intervention (composed of environmental modifications, safe swallowing advice and appropriate dietary modifications; n=102), or standard high-intensity intervention and dietary prescription (daily direct swallowing exercises, dietary modification; n=102). Treatment continued for up to a month.	Primary outcome: Proportion of patients who had returned to their pre-stroke diet by 6 months. Secondary outcomes: Time to return to a normal diet, recovery of functional swallowing, number of dysphagia-related medical complications, death, need for institutionalization, dependency in ADL by 6 months after stroke.	Combining high-intensity and low-intensity groups into a single treatment group and comparing with the usual care group: Normal diet at 6 months: RR=1.19, 95% CI 0.98 to 1.45, p>0.05 Return to functional swallow: RR=1.41, 95% CI 1.03 to 1.94, p<0.05. Chest infection: RR=0.56, 95% CI 0.41 to 0.76, p<0.05 Death: RR=0.80, 95% CI 0.49 to 1.3, p>0.05 Institutionalization: RR=0.69, 95% CI 0.43 to 1.1, p>0.05 Dependency (Rankin ≥3) RR=1.05, 95% CI 0.82 to 1.3, p>0.05 Death or institutionalization: RR=0.73 95% CI 0.55 to 0.97, p<0.05 Dropouts and losses to follow-up: usual care n=23, low-intensity group n=21, high-intensity group n=19 Adverse events: No reporting
De Pippo et al. 1994	CA: <input checked="" type="checkbox"/> Blinding:	115 patients admitted to an inpatient rehabilitation unit an average of 5.6	Patients were randomized to receive 1 of 3 treatment protocols:	Primary outcome: Pneumonia	The number of patients meeting a study end point in groups 1, 2 and 3

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
USA RCT	Patient <input checked="" type="checkbox"/> Assessor <input checked="" type="checkbox"/> ITT: <input checked="" type="checkbox"/>	weeks following confirmed stroke with VMBS evidence of dysphagia and failure on the Burke Dysphagia Screening Test	Group 1 (n=38) received one formal dysphagia treatment session and choice of modified-texture diet recommended by the SLP based on the results of the VMBS study; Group 2 (n=38) also received one dysphagia session, but were prescribed a texture-modified diet by the SLP; Group 3 received the same formal dysphagia treatment session, with an SLP controlled diet. Patients in group 3 were also seen daily by the SLP and received additional instructions in compensatory strategies.	Secondary outcome: Dehydration, calorie-nitrogen deficit, recurrent upper-airway obstruction, death Patients were followed for the duration of their inpatient stay and for 1 year. Follow-up data was collected by telephone interview at 3,6 and 12 months	Any end point: 6 vs. 7 vs. 5, p>0.05 There was no difference between groups in time to end point. Pneumonia: 1 vs. 5 vs. 2, p>0.05 Dehydration: 3 vs. 0 vs. 1, p>0.05 Calorie-nitrogen deficient: 2 vs. 2 vs. 3, p>0.05 Recurrent upper-airway obstruction: 1 vs. 0 vs. 0, p>0.05 Death: 0 vs. 0 vs. 0, p>0.05 Dropouts: n=1

Evidence Tables (Nutrition)

Enteral Feeding

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Gomes et al. 2015 Brazil Cochrane review	NA	11 RCTs (735 participants, 462 with stroke), including adults with swallowing disturbances or dysphagia, with an indication for nutritional support.	Trials compared enteral feeding using NG vs. PEG devices	Primary outcome: Treatment failure (feeding interruption due to blocked or dislodged tubes, or non-adherence) Secondary outcomes: mortality, nutritional status, pneumonia, adverse events	Length of follow-up ranged from 4 weeks to 6 months. PEG feeding was associated with a significantly reduced risk of treatment failure including feeding interruption, blocking or leakage of the tube, non-adherence (RR= 0.18, 95% CI 0.05-0.59). Results from 8 trials included. PEG feeding was not associated with a significantly reduced risk of mortality at end of follow-up (RR=

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
					0.86, 95% CI 0.58-1.28). Results from 9 trials included. PEG feeding was not associated with a significantly reduced risk of adverse events or pneumonia (RR= 0.83, 95% CI 0.51-1.34, results from 6 trials and RR= 0.70, 95% CI 0.46-1.06, results from 7 trials, respectively).
Geeganage et al. 2012 UK Cochrane Review	NA	33 RCTs (6,779 subjects) examining a variety of interventions associated with dysphagia and nutrition provided within the first 6 months of stroke onset.	Enteral nutrition treatment interventions examined included: routes of feeding (PEG vs. NG tube feeding, 5 RCTs), and timing of feeding (early vs. late, 1 RCT), Dysphagia interventions and outcomes reported above in dysphagia section	Primary outcomes: Case fatality, death or dependency, institutionalization Secondary outcomes: LOS, pressure sores, chest infection, dysphagia at end of trial, treatment failures, gastrointestinal bleeding, percentage of feed delivered, weight at end of trail, mid-arm circumference, albumin	PEG vs. NF tube feeding PEG feeding was not associated with a reduction in the odds of case fatality at end of trial (OR=0.81, 95% CI 0.42 to 1.56, p=0.53. Results from 5 trials included). PEG feeding was not associated with a reduction in the odds death or dependency at end of trial (OR=0.80, 95% CI 0.12 to 5.55, p=0.82. Results from 3 trials included). PEG feeding was not associated with significant reductions in the odds of pressure sores, dysphagia at the end of trail, institutionalization or chest infections. PEG feeding was associated with significantly fewer treatment failures (OR= 0.09; 95% CI 0.01 to 0.51, p = 0.007), GI bleeding (OR= 0.25; 95% CI 0.09 to 0.69; Pp= 0.007), and higher percentage of feed delivery (MD= 22.00; 95% CI 16.15 to 27.85; p < 0.00001) and higher albumin concentration (MD= 4.92 g/L,95% CI 0.19 to 9.65; p= 0.04). Timing of feeding Early feeding was not associated with significant reductions in case fatality, death or dependency or the need for institutionalization compared with late feeding
The FOOD trial 2005 (part I- timing and method of	CA: <input checked="" type="checkbox"/> Blinding: Patient <input checked="" type="checkbox"/> Assessor <input checked="" type="checkbox"/>	1,210 patients admitted within 7 days of first or recurrent stroke, from 47 hospitals in 11 countries	i) Patients were randomized to receive either a PEG (n=162) or NG feeding tube (n=159) within 3 days of enrolment	Primary outcome: Death and poor outcome (defined as a Modified Rankin Score of 4-5) was assessed at 6 months.	Early vs. avoid groups Early tube feeding was associated with a 1.2% (-4.2 to 6.6, p=0.7) absolute reduction in the risk of death or poor outcome at 6 months

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
feeding) UK RCT	ITT: <input checked="" type="checkbox"/>		into the study ii) Patients were randomized to receive feeds as early as possible (n=429) or to avoid feeding for 7 days (n=460) using either a PEG or NG feeding tube.		Early tube feeding was associated with a 15.8% (-0.8 to 12.5, p=0.09) absolute reduction in the risk of death at 6 months PEG vs. NG group PEG feeding was associated with an absolute increase in risk of death of 1.0% (-10.0 to 11.9, p=0.9) PEG feeding was associated with and an increased risk of death or poor outcome of 7.8% (0.0 to 15.5, p=0.05) Losses to follow-up: n=1 Adverse events: Gastro-intestinal bleeds occurred more frequently in the early feeding group compared with the late group (22 vs. 11, p=0.04) and with NG tubes compared with PEG (18 vs. 5, p=0.005). There were more pressure sores in the PEG group compared with NG (12 vs. 4, p=0.04).
Hamidon et al. 2006 Malaysia RCT	CA: <input checked="" type="checkbox"/> Blinding: Patient <input checked="" type="checkbox"/> Assessor <input checked="" type="checkbox"/> ITT: <input checked="" type="checkbox"/>	23 consecutive patients admitted with acute ischemic stroke with persistent dysphagia for ≥7 days.	Patients were randomized to receive either an NG (n=13) or PEG feeding tube (n=10).	Primary outcomes: Changes in nutritional indices at 4 weeks follow-up including: triceps skinfold (TSF), bicep skinfold (BSF), mid-arm circumference (MAC), serum albumin, and treatment failure, defined as persistent blocked or dislodged tubes	22 patients completed the study. At the end of four weeks, subjects in the PEG group had significant increase in the median serum albumin values compared with baseline, whereas subjects in the NG group experienced a decrease (+2.5 vs. -5.0 g/L, p=0.045). There were more treatment failures in the NG group (5/10 vs. 0/8, p=0.036). There were no other significant differences between groups.
Norton et al. 1996 UK RCT	CA: <input checked="" type="checkbox"/> Blinding: Patient <input checked="" type="checkbox"/> Assessor <input checked="" type="checkbox"/>	30 patients admitted to 2 hospitals with severe stroke, who were unconscious at the time of admission and with dysphagia which	At a mean of 14 days post stroke, patients were randomized to receive either a gastrostomy (G, n=16) feeding tube or nasogastric (NG, n=14)	Primary outcomes: Mortality at 6 weeks after initiation of feed and changes in nutritional state during this period.	At 6 weeks, a significantly greater proportion of patients had died in the NG group compared to patients in the G group (2 vs 8). Patients in the G group had significantly better nutritional indices including weight, serum albumin,

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
	ITT: <input checked="" type="checkbox"/>	persisted for ≥ 8 days. Mean age was 77 years, 63% female. Mean Barthel Index score at randomization was 3.	feeding tube for enteral feeding.	Secondary outcomes: Treatment failure, LOS	mid-arm circumference. There were no omitted feeds among patients in the G group compared to at least one missed feed in 10 patients in the NG group.

Oral Supplementation (Energy & Protein)

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Geeganage et al. 2012 UK Cochrane Review	NA	33 RCTs (6,779 subjects) examining a variety of interventions associated with dysphagia and nutrition provided within the first 6 months of stroke onset.	Treatment interventions examined included: oral sip supplementation vs. no supplementation (n=7 trials). Dysphagia and enteral feeding interventions and outcomes are reported above in their respective sections.	Primary outcomes: Case fatality, death or dependency, institutionalization Secondary outcomes: LOS, pressure sores, chest infection, dysphagia at end of trial, pressure sores, energy and protein intake, serum albumin	Oral supplementation was not associated with a reduction in the odds of case fatality, death or dependency, the need for institutionalization, or mean LOS. Oral supplementation was associated with a reduction in the odds of pressure sores (OR=0.56, 95% CI 0.32 to 0.96, p=0.034, results from 2 trials included) and an increase in daily mean energy and protein intake (results from 3 trials included). The authors concluded that nutritional supplements do not appear to be of value to the majority of patients except for those who are malnourished or in those who are at risk of malnutrition.
Milne et al. 2009 UK Cochrane Review	NA	62 RCTs (10,187 elderly subjects). Most participants (71%) were hospitalised in-patients admitted for acute conditions. 40 studies included older people with no specified disease or condition, Other studies included patients with hip fracture, stroke patients, (n=2) congestive heart failure, chronic obstructive pulmonary disease, older surgical	Interventions included commercial oral supplements or fortification of normal food with the intention of improving protein and energy intake using only the normal oral route. The control condition was usually routine feed (no supplement). The trials aimed to provide between 175 and 1350 additional kcal/Day and an additional	Primary outcomes: All-cause mortality, morbidity, number of people with complications, functional status	Mortality: RR=0.92, 95% CI 0.81 to 1.04, p=0.20. Results from 40 trials included) Mortality (malnourished at study entrance subgroup): RR=0.79, 95% CI 0.64 to 0.97, p=0.025. Results from 25 trials included Complications: RR=0.86, 95% CI 0.75 to 0.99, p=0.029. Results from 24 trials included Weight change (%): MD=2.15, 95% CI 1.80 to 2.49, p<0.0001. Results from 45 trials included 15 % Arm muscle circumference change: MD=1.20, 95% CI 0.45 to 1.96, p= 0.0019. (favors treatment). Results from 16 trials included

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
		patients and patients at home with diabetic foot ulcer.	10-50 g rams of protein/day. Therapy lasted from 10 days to 18 months (< 35 days in 17 trials, ≥ 35 days in 37 trials, from admission to discharge in 5 trials)		LOS: MD= -0.75, 95% CI -2.84 to 1.34, p=0.48. Results from 14 trials included
Ha et al. 2010 Norway RCT	CA: <input checked="" type="checkbox"/> Blinding: Patient <input checked="" type="checkbox"/> Assessor <input checked="" type="checkbox"/> ITT: <input checked="" type="checkbox"/>	124 acute stroke patients who were malnourished or at nutritional risk, identified by screening within 7 days of admission to hospital were included.	Patients were randomized to receive either individualized, nutritional care to prevent weight loss (n=58) or routine care (n=66) while in hospital. Patients in the intervention group were prescribed oral supplements and tube feeding when appropriate. Education to prevent was also provided prior to hospital discharge. In the control group, patients received oral sip feedings or tube feeding at the discretion of the attending physician. There were no standardized procedures for the treatment of malnutrition. Patients remained in hospital an average of 11 days.	Primary outcome: Percentage of patients with weight loss ≥5% at 3 months. Secondary outcomes: QoL (EQ-5D), handgrip strength, length of hospital stay, energy and protein intake Assessments were conducted at baseline and at 3 months	Patients in the intervention group received significantly more calories: Mean ±sd Kj/kg/day 80±29 vs. 64±20, p=0.005, but not protein g/kg/day: 0.8±0.3 vs. 0.7±0.3, p=0.34. % of patients in the intervention and control groups with weight loss ≥5% at 3 months: 20.7% vs. 36.4%, p=0.055 EQ-5D: There were no significant differences between groups on any of the domains. Patients in the intervention group experienced significant improvement in means scores of mobility, self-care and usual activities. There was no significant improvement in scores on any of the dimensions for patient in the control group. Mean (95% CI) improvement in hand grip strength: 2.6 (1.0 to 4.2) kg, p=0.002. Favors intervention Median (range) LOS (days) for patients in the intervention and control groups: 12 (2-54) vs. 13 (3-55) days, p>0.05 Losses to follow-up: n=58 intervention group, n=18 control group
The FOOD trial 2005 (part 2- oral supplementation) UK	CA: <input checked="" type="checkbox"/> Blinding: Patient <input checked="" type="checkbox"/> Assessor <input checked="" type="checkbox"/>	4,023 non-dysphagic patients admitted within 7 days of first or recurrent stroke. Clinician unsure whether to provide supplements (8% of patients)	Patients were randomized to receive or not receive, an oral nutritional supplement (540 Kcals) in addition to a regular hospital diet, provided for the duration	Primary outcome: Death or disability (mRS score of 3-5) at 6 months Secondary outcomes: mRS, EUROQoL, place of residence at 6 months	Death: OR=0.94, 95% CI 0.78 to 1.17, p, p>0.05 Absolute difference in risk of death: 0.7%, 95% CI -1.4 to 2.7 Death or poor outcome: OR=1.03, 95% CI 0.91 to 1.17, p>0.05 Absolute risk of death or poor outcome; 0.7%, 95%

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
RCT	ITT: <input checked="" type="checkbox"/>	malnourished at baseline)	of their entire hospital stay (median duration of hospital stay was 34 days- 28% of patients stopped taking supplements before discharge).		<p>CI -2.3 to 3.8.</p> <p>Mean difference in EROQoL scores between groups: 0.001, 95% CI -0.23 to 0.025, p>0.05</p> <p>Losses to follow-up and drop-outs: n=26 (regular diet), n=245 (supplement)</p> <p>Adverse events: no significant differences in complications (pneumonia, urinary tract infections etc) between groups</p>
Gariballa et al. 1998 UK RCT	CA: <input checked="" type="checkbox"/> Blinding: Patient <input checked="" type="checkbox"/> Assessor <input checked="" type="checkbox"/> ITT: <input checked="" type="checkbox"/>	42 patients who were conscious during the first week of stroke onset with intact swallowing and showed anthropometric evidence of malnutrition	Patients were randomized to receive a standard hospital diet or a standard diet plus an oral supplement supplying an additional 1200 Kcals, 40g protein daily for 4 weeks.	<p>Primary outcome: Change in nutritional indicators</p> <p>Secondary outcomes: Barthel Index (BI), infective complications, death within 3 months and discharge location</p> <p>Outcomes were assessed at baseline, and weeks 2, 4 and 12.</p>	<p>Patients in the supplemented group consumed significantly more calories and protein compared with those in the control group: 1,807 vs. 1,084 Kcals, p<0.001; protein 65.4 vs. 44.1 grams, p<0.001</p> <p>There were no significant mean changes from baseline to week 12 between groups in: Weight (kg): 0.2 vs. -0.7, p>0.05 Tricep skinfold; (mm) -0.9 vs. -0.6, p>0.05 Mid-arm muscle circumference (cm): -0.3 vs. -0.3, p>0.05 Serum transferrin (g/L): 0.1 vs. -0.3, p>0.05</p> <p>There was no significant difference between groups in median BI change (45 to 90 vs. vs. 35 to 75, p>0.05).</p> <p>Serum albumin (g/L) dropped significantly less in the supplemented group (-1.5 vs. -4.4, p=0.025)</p> <p>Serum iron (µmol/L) increased in the supplemented group and decreased in the control group (2.6 vs. -2.7, p=0.03).</p> <p>There were 9 infective complications in the supplement group and 11 in the control group, p>0.05. There were 2 deaths in the supplemented group and 7 in the control group (p=0.127).</p> <p>There were 11 losses to follow-up</p>

Oral Hygiene

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
<p>Murray & Scholten 2017</p> <p>Australia</p> <p>Combined data from RCT + observational study</p>	NA	89 patients recruited from 3 stroke units, with a confirmed diagnosis of stroke.	The outcomes of patients with (n=12) and without dysphagia (n=77) following 7 days of an oral care intervention, which included teeth or denture brushing with normal toothpaste twice daily, after breakfast and in the evening, and rinsing of the mouth after lunch. The standard of care on the stroke unit was once-daily (morning) teeth brushing.	<p>Primary outcome:</p> <p>Oral Health Assessment Tool (OHAT)</p>	<p>Patients with dysphagia were older (79 vs. 69 yrs, p<0.003) and recruited sooner after stroke (19.8 vs. 41.1 days, p=0.038).</p> <p>For patients with dysphagia, there was significant improvement in median OHAT scores from day 0 to day 7 (4 to 3, p=0.024). 59% of participants had an improvement in their oral health scores of 1 or more points.</p> <p>For patients without dysphagia, there was no significant improvement in median OHAT scores from day 0 to day 7 (2 to 2, p=0.282). 29% of the participants had improved oral health scores at day 7.</p> <p>The median OHAT scores were significantly different at baseline and after 7 days, between dysphagic and non-dysphagic patients.</p>
<p>Kim et al. 2014</p> <p>Korea</p> <p>RCT</p>	<p>CA: ☒</p> <p>Blinding: Patient ☒ Assessor ☒</p> <p>ITT: ☒</p>	90 patients consecutively admitted to a neurosurgical ICU following first-ever stroke, who had ≥6 teeth, and with no sign of infection with any contagious pathogen	Patients were randomized to an intervention (n=45) or control group (n=45). Patients in the intervention group received daily oral hygiene including tooth brushing, tongue cleaning and chlorhexidine application, performed by a dentist. Unclear what treatment patients in the control group received.	<p>Primary outcomes:</p> <p>Plaque Index (PI), Silness & Loe, 1964; Scores range from 0-3 with lower scores indicating better oral hygiene status; Gingival Index (GI) (Loe 1967). Scores range from 0-3 with lower scores indicating less gingival inflammation; Clinical Attachment Loss (CAL)</p> <p>Secondary outcomes:</p> <p>Candida colony counts of tongue and saliva</p>	<p>34 patients dropped out during the first week. Data from 56 patients were used for analysis.</p> <p>Mean duration of treatment in the intervention group was 2.2 weeks.</p> <p>There was a significant decrease in mean PI scores from baseline to follow-up (mean 2.2 weeks) in both groups, although the decline was significantly greater in the intervention group (-1.24 vs. -0.25, p=0.001).</p> <p>There was a significant decrease in mean GI scores from baseline to follow-up (mean 2.2 weeks) in the intervention group (1.54 to 0.47, p=0.018, and a significant increase in the control group (1.3 to 1.60, p=0.023).</p> <p>There was no significant difference between groups in mean CAL change scores from baseline to follow-up.</p>

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
					A significantly greater proportion of patients with no Candida colonization in the saliva increased from baseline to follow-up among patients in the intervention group
Lam et al. 2013 China RCT	CA: <input checked="" type="checkbox"/> Blinding: Patient <input checked="" type="checkbox"/> Assessor <input checked="" type="checkbox"/> ITT: <input checked="" type="checkbox"/>	102 dentate patients admitted to a rehabilitation unit following ischemic stroke or ICH within the previous 7 days, with a Barthel index score of <70. Mean age was 70 years.	Patients were randomized to receive oral hygiene instruction (OHI, n=33), OHI + chlorhexidine (CHI) mouth rinse, (n=34), or OHI + CHI + assisted tooth brushing (n=35) twice daily for 3 weeks	Primary outcomes: Plaque Index (PI) (Silness & Loe, 1964). Scores range from 0-3 with lower scores indicating better oral hygiene status. Gingival Bleeding Index (GBI, Carter & Barnes, 1974). The presence or absence of gingival inflammation is noted after passing unwaxed dental floss at 6 sites into the proximal sulci. Bleeding is recorded as present or absent (0,1). Secondary outcomes: Pneumonia, treatment satisfaction. Outcomes were assessed before and after treatment	At baseline, only 33% of patients reported brushing their teeth daily. The mean PI scores of patients in the OHI+CHX and OHI+CHX+assisted brushing groups were improved significantly more than patients in the OHI group (p<0.001) Mean before/after treatment scores OHI: 2.0 to 1.2, OHI+CHX: 1.9 to 0.6, OHI+CHX+ assisted brushing: 1.9 to 0.5. The mean GBI score of patients in the OHI+CHX group was improved significantly more than patients in the OHI group (p<0.032) Mean before/after treatment scores OHI: 16.7 to 17.7, OHI+CHX: 18.8 to 10.0, OHI+CHX+ assisted brushing: 16.7 to 7.6. No patient in either group developed pneumonia during the treatment period. Only 1 patient dropped out of the study due to non-compliance with CHX treatment.
Lam et al. 2011 China Systematic review	NA	8 studies that aimed to assess the effectiveness of oral health promotion activities in patients with cardiovascular disease. Patients included in these studies were diagnosed with hypertension (n=2), coronary artery disease and/or a previous coronary event (n=3) or were recovering from heart transplants (n=1). In one study, 67 patients	Most interventions evaluated included cleaning, scaling, root planing and/or extractions. In the single RCT that included patients following stroke, an oral health care education program (OHCE) was provided to nursing home care assistants vs. delayed intervention.	Primary outcome: Periodontal health	Results from stroke-specific study There were no differences between groups in dental plaque, gingivitis, or denture-induced stomatitis at 1 and 6 months. The experimental group exhibited significantly less denture plaque than the control group at 1 and 6 months (p<0.0001) Nursing staff receiving OHCE program exhibited higher knowledge scores (p<0.005) at 1 month, and 6 months (p<0.001) and significantly better attitudes to oral care (p= 0.001)

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Brady et al. 2006 UK Cochrane review	NA	<p>residing in 20 nursing homes following stroke, were included.</p> <p>3 RCTs (n=470) that included patients with a diagnosis of stroke receiving some form of assisted oral health care (OHC) within a healthcare facility.</p> <p>Patients included in these trials had been admitted to a neurological ICU (n=1), an acute stroke unit (n=1) and nursing homes (n=1).</p>	<p>Treatment contrasts included: OHC + timed tooth brushing in care bundle vs. standard care (n=1), OHC health care education session vs. delayed session (n=1) and selective decontamination of digestive tract using Orabase 500 mg gel applied to the mucous membranes of the mouth four times daily for 2-3 weeks (n=1).</p>	<p>Primary outcomes: Dental plaque (Plaque scale), Denture plaque (Denture Cleanliness Scale)</p> <p>Secondary outcomes: Patient satisfaction with care received, oral comfort and appearance, presence of oral disease: gingivitis; denture-induced stomatitis; periodontal disease and staff oral health knowledge and attitudes</p>	<p>Pooled analyses were not possible.</p> <p>Use of decontamination gel was associated with a reduction in the incidence of pneumonia: (OR=0.20, CI 95% 0.05 to 0.84, p = 0.03).</p> <p>Education session was not associated with a reduction in dental plaque tooth coverage, the presence of gingivitis, or denture-induced stomatitis at one or 6 months following training, but was associated with a significant reduction in denture plaque at both assessment points.</p> <p>One month after the educational session, care assistants that received the training had higher knowledge scores than the delayed group.</p>

Abbreviations

BI = Barthel Index	CA = Concealed Allocation
pCI = Confidence Interval	FEES = Fiberoptic Examination of Swallowing Safety
IQR = Interquartile Range	ITT = Intention to treat
N/A = Not Assessed	OR = Odds Ratio
PEG = Percutaneous Endoscopic Gastronomy	RCT= Randomized Controlled Trial
SMD = Standardized Mean Difference	VSF = Video Fluoroscopic Swallowing

Reference List

- Al-Khaled M, Matthis C, Binder A, et al. Dysphagia in Patients with Acute Ischemic Stroke: Early Dysphagia Screening May Reduce Stroke-Related Pneumonia and Improve Stroke Outcomes. *Cerebrovasc Dis* 2016;42(1-2):81-89.
- Bath PM, Lee HS, Everton LF. Swallowing therapy for dysphagia in acute and subacute stroke. *Cochrane Database Syst Rev* 2018, Issue 10. Art. No.: CD000323. DOI: 10.1002/14651858.CD000323.pub3.
- Bath PM, Scutt P, Love J, Clave P, Cohen D, Dziewas R, et al. Pharyngeal Electrical Stimulation for Treatment of Dysphagia in Subacute Stroke: A Randomized Controlled Trial. *Stroke* 2016;47(6):1562-70.
- Brady M, Furlanetto D, Hunter RV, Lewis S, Milne V. Staff-led interventions for improving oral hygiene in patients following stroke. *Cochrane Database Syst Rev* 2006 Issue 4. Art. No.: CD003864. DOI: 10.1002/14651858.CD003864.pub2.
- Bray BD, Smith CJ, Cloud GC, et al. The association between delays in screening for and assessing dysphagia after acute stroke, and the risk of stroke-associated pneumonia. *J Neurol Neurosurg Psychiatry* 2017;88:25-30.
- Carnaby G, Hankey GJ, Pizzi J. Behavioural intervention for dysphagia in acute stroke: a randomised controlled trial. *Lancet Neurol* 2006;5:31-37.
- Carnaby-Mann GD, Cray MA. Examining the evidence on neuromuscular electrical stimulation for swallowing: a meta-analysis. *Arch Otolaryngol Head Neck Surg.* 2007;133(6):564-71.
- Dennis MS, Lewis SC, Warlow C. Effect of timing and method of enteral tube feeding for dysphagic stroke patients (FOOD): a multicentre randomised controlled trial. *Lancet* 2005;365:764-72.
- Dennis MS, Lewis SC, Warlow C. Routine oral nutritional supplementation for stroke patients in hospital (FOOD): a multicentre randomised controlled trial. *Lancet* 2005;365:755-63.
- DePippo KL, Holas MA, Reding MJ, et al. Dysphagia therapy following stroke: a controlled trial. *Neurology* 1994;44:1655-60.
- Du J, Yang F, Liu L, et al. Repetitive transcranial magnetic stimulation for rehabilitation of poststroke dysphagia: A randomized, double-blind clinical trial. *Clin Neurophysiol* 2016;127(3):1907-1913.
- Gariballa SE, Parker SG, Taub N, et al. A randomized, controlled, a single-blind trial of nutritional supplementation after acute stroke. *JPEN J Parenter Enteral Nutr* 1998;22:315-19.
- Geeganage C, Beavan J, Ellender S, et al. Interventions for dysphagia and nutritional support in acute and subacute stroke. *Cochrane Database Syst Rev* 2012;10:CD000323.
- Gomes Jr CAR, Andriolo RB, Bennett C, Lustosa SAS, Matos D, Waisberg DR, Waisberg J. Percutaneous endoscopic gastrostomy versus nasogastric tube feeding for adults with swallowing disturbances. *Cochrane Database of Systematic Reviews* 2015, Issue 5. Art. No.: CD008096. DOI: 10.1002/14651858.CD008096.pub4.
- Ha L, Hauge T, Iversen PO. Body composition in older acute stroke patients after treatment with individualized, nutritional supplementation while in hospital. *BMC Geriatr* 2010;10:75.
- Ha L, Hauge T, Spenning AB, et al. Individual, nutritional support prevents undernutrition, increases muscle strength and improves QoL among elderly at nutritional risk hospitalized for acute stroke: a randomized, controlled trial. *Clin Nutr* 2010;29:567-73.
- Hamidon B, Abdullah S, Zawawi M, Sukumar N, Aminuddin A, Raymond A. A prospective comparison of percutaneous endoscopic gastrostomy and nasogastric tube feeding in patients with acute dysphagic stroke. *Med J Malaysia* 2006;61(1):59-66.
- Hinchey JA, Shephard T, Furie K, et al. Formal dysphagia screening protocols prevent pneumonia. *Stroke* 2005;36:1972-76.
- Ho CH, Lin WC, Hsu YF, Lee IH, Hung YC. One-Year Risk of Pneumonia and Mortality in Patients with Poststroke Dysphagia: A Nationwide Population-Based Study. *J Stroke Cerebrovasc Dis* 2018;27(5):1311-1317.
- Joundi RA, Martino R, Saposnik G, Giannakeas V, Fang J, Kapral MK. Predictors and Outcomes of Dysphagia Screening After Acute Ischemic Stroke. *Stroke* 2017;48(4):900-906.

- Khedr EM, Abo-Elfetoh N, Rothwell JC. Treatment of post-stroke dysphagia with repetitive transcranial magnetic stimulation. *Acta Neurol Scand* 2009;119(3):155-61.
- Kim E, Jang S, Choi YH, Lee K, et al. Effect of an oral hygienic care program for stroke patients in the intensive care unit. *Yonsei Medical Journal* 2014;55: 240-6
- Lakshminarayan K, Tsai AW, Tong X, et al. Utility of dysphagia screening results in predicting poststroke pneumonia. *Stroke* 2010;41:2849-54.
- Lam OL, McMillan AS, Samaranayake LP, Li LS, McGrath C. Randomized clinical trial of oral health promotion interventions among patients following stroke. *Arch Phys Med Rehabil* 2013;94:435-443.
- Lam OL, Zhang W, Samaranayake LP, Li LS, McGrath C. A systematic review of the effectiveness of oral health promotion activities among patients with cardiovascular disease. *Int J Cardiol* 2011;151:261-267.
- Lim KB, Lee HJ, Lim SS, et al. Neuromuscular electrical and thermal-tactile stimulation for dysphagia caused by stroke: a randomized controlled trial. *J Rehabil Med* 2009;41:174-
- Lim KB, Lee HJ, Yoo J, Kwon YG. Effect of Low-Frequency rTMS and NMES on Subacute Unilateral Hemispheric Stroke With Dysphagia. *Ann Rehabil Med* 2014;38(5):592-602.
- Masur, S., Smith, E. E., Saver, J. L., Reeves, M. J., Bhatt, D. L., Zhao, X. et al. Dysphagia screening and hospital-acquired pneumonia in patients with acute ischemic stroke: Findings from Get with the Guidelines-Stroke. *J Stroke Cerebrovasc Dis.* 2013;22:e301-309.
- Middleton S, McElduff P, Ward J, et al. Implementation of evidence-based treatment protocols to manage fever, hyperglycaemia, and swallowing dysfunction in acute stroke (QASC): a cluster randomised controlled trial. *Lancet* 2011;378:1699-706.
- Miles A, Zeng IS, McLauchlan H, Huckabee ML. Cough reflex testing in dysphagia following stroke: a randomized controlled trial. *J Clin Med Res* 2013;5(3):222-233.
- Milne AC, Potter J, Vivanti A, et al. Protein and energy supplementation in elderly people at risk from malnutrition. *Cochrane Database Syst Rev* 2009;CD003288.
- Murray J, Scholten I. An oral hygiene protocol improves oral health for patients in inpatient stroke rehabilitation. *Gerodontology* 2018 Mar;35(1):18-24.
- Norton B, Homer-Ward M, Donnelly MT, Long RG, Holmes GK. A randomised prospective comparison of percutaneous endoscopic gastrostomy and nasogastric tube feeding after acute dysphagic stroke. *BMJ* 1996;312:13-16.
- Park JS, Oh DH, Hwang NK, Lee JH. Effects of neuromuscular electrical stimulation combined with effortful swallowing on post-stroke oropharyngeal dysphagia: a randomised controlled trial. *J Oral Rehabil* 2016;43(6):426-34.
- Park JW, Oh JC, Lee JW, Yeo JS, Ryu KH. The effect of 5Hz high-frequency rTMS over contralesional pharyngeal motor cortex in post-stroke oropharyngeal dysphagia: a randomized controlled study. *Neurogastroenterol Motil* 2013. 25:324-e250.
- Rai N, Prasad K, Bhatia R, Vibha D, Singh MB, Rai VK, Kumar A. Development and implementation of acute stroke care pathway in a tertiary care hospital in India: A cluster-randomized study. *Neurol India* 2016;64, Suppl S1:39-45.
- Shigematsu T, Fujishima I, Ohno K. Transcranial direct current stimulation improves swallowing function in stroke patients. *Neurorehabil Neural Repair.* 2013;27(4):363-9.
- Smith EE, Kent DM, Bulsara KR, Leung LY, Lichtman JH, Reeves MJ, Towfighi A, Whiteley WN, Zahuranec DB; on behalf of the American Heart Association Stroke Council. Effect of dysphagia screening strategies on clinical outcomes after stroke: a systematic review for the 2018 guidelines for the early management of patients with acute ischemic stroke. *Stroke*.2018 Mar;49(3):e123-e128.
- Suntrup-Krueger S, Ringmaier C, Muhle P, Wollbrink A, Kemmling A, Hanning U, et al. Randomized trial of transcranial direct current stimulation for poststroke dysphagia. *Ann Neurol* 2018;83(2):328-40.
- Terre R, Mearin F. A randomized controlled study of neuromuscular electrical stimulation in oropharyngeal dysphagia secondary to acquired brain injury. *Eur J Neurol* 2015;22(4):687-e44.
- Vasant DH, Michou E, O'Leary N, Vail A, Mistry S, Hamdy S. Pharyngeal Electrical Stimulation in Dysphagia Poststroke: A Prospective, Randomized Single-Blinded Interventional Study. *Neurorehabil Neural Repair* 2016;30(9):866-75.

Xia W, Zheng C, Lei Q, et al. Treatment of post-stroke dysphagia by vitalstim therapy coupled with conventional swallowing training. *J Huazhong Univ Sci Technolog Med Sci* 2011;31:73-76.