HEART & STROKE FOUNDATION | CANADIAN Stroke BEST PRACTICE RECOMMENDATIONS

CANADIAN STROKE BEST PRACTICE RECOMMENDATIONS

Stroke Rehabilitation Evidence Tables

Management of Dysphagia and Malnutrition following Stroke

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Table of Contents

Search Strategy…… 3

Published Guidelines…… 4

Summary of Dysphagia Interventions and Associated Strength of Evidence from Selected Guideline Documents…… 9

Dysphagia Screening and Assessment…… 11

Dysphagia Treatment…… 12

Summary of Nutritional Interventions and Associated Strength of Evidence from Selected Guideline Documents…… 19

Enteral Feeding…… 20

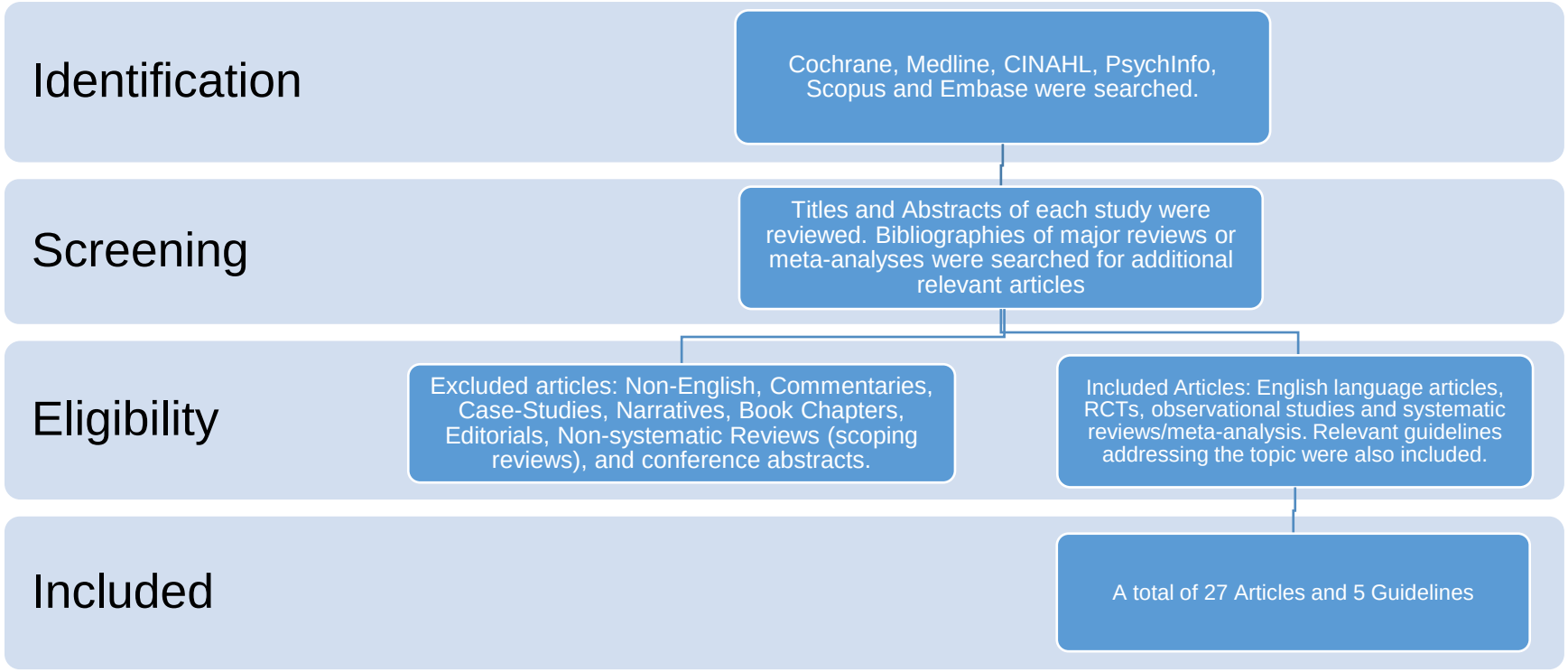
Oral Supplementation (Energy and Protein)…… 21

Lifestyle Interventions Post-Stroke…… 23

Pediatric Stroke…… 24

Reference List…… 26

Search Strategy



Cochrane, Medline, CINAHL, PsychInfo, Scopus and Embase were search using the terms “stroke” and “nutrition” or “dysphagia”. Titles and abstract of each article were reviewed for relevance. Bibliographies were reviewed to find additional relevant articles. One new section, Nutritional Lifestyle Interventions was added for the 2014 update. The same databases were searched to identify paediatric related evidence using the additional keywords: “(pediatric OR pediatrics OR paediatric OR paediatrics OR youth OR child OR children OR young)”. 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 27 articles and 5 guidelines were included and were separated into separate categories designed to answer specific questions.

Published Guidelines

Guideline	Recommendations
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	**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) Patients with dysphagia should have an oropharyngeal swallowing rehabilitation programme that includes restorative exercises in addition to compensatory techniques and diet modification. (B) **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) 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) 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) **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)
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	**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) **Nutrition Management** The nutritional and hydration status of stroke patients should be assessed within the first 48 hours of admission. (No level of recommendation) Stroke patients with suspected nutritional and/or hydration deficits, including dysphagia, should be referred to a dietitian. (No level of recommendation)

Guideline	Recommendations
	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) 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)
Clinical Guidelines for Stroke Management 2010. Melbourne (Australia): National Stroke Foundation; 2010 Sep. p. 81-82; 97-98.	**Dysphagia Screening/Assessment** Patients should be screened for swallowing deficits before being given food, drink or oral medications. Personnel specifically trained in swallowing screening using a validated tool should undertake screening. (B). Swallowing should be screened for as soon as possible but at least within 24 hours of admission.(GPP) The gag reflex is not a valid screen for dysphagia and should NOT be used as a screening tool. (B). Patients who fail the swallowing screening should be referred to a speech pathologist for a comprehensive assessment. This may include instrumental examination (e.g., videofluoroscopic modified barium swallow [VMBS] and/or fibre-optic endoscopic evaluation of swallowing [FEES]). Special consideration should be given to assessing and managing appropriate hydration. These assessments can also be used for monitoring during rehabilitation. (GPP) **Dysphagia Treatment** Compensatory strategies such as positioning, therapeutic manoeuvres or modification of food and fluids to facilitate safe swallowing should be provided for people with dysphagia based on specific impairments identified during comprehensive swallow assessment. (B) One or more of the following methods can be provided to facilitate resolution of dysphagia: Therapy targeting specific muscle groups (C), thermo-tactile stimulation (C), electrical stimulation if it is delivered by clinicians experienced with this intervention, applied according to published parameters and employing a research or quality framework. (C) Dysphagic patients on modified diets should have their intake and tolerance to diet monitored. The need for continued modified diet should be regularly reviewed. (GPP) Patients with persistent weight loss and recurrent chest infections should be urgently reviewed. (GPP) All staff and carers involved in feeding patients should receive appropriate training in feeding and swallowing techniques. (GPP) **Nutrition & Hydration** All stroke patients should have their hydration status assessed, monitored and managed. Appropriate fluid supplementation should be used to treat or prevent dehydration. (B) All patients with stroke should be screened for malnutrition. (B)

Guideline	Recommendations
	Patients who are at risk of malnutrition, including those with dysphagia, should be referred to a dietitian for assessment and ongoing management. (GPP) Screening and assessment of nutritional status should include the use of validated nutritional assessment tools or measures. (B) Nutritional supplementation should be offered to people whose nutritional status is poor or deteriorating. (A) Nasogastric tube feeding is the preferred method during the first month post stroke for people who do not recover a functional swallow. (B) Food intake should be monitored for all people with acute stroke. (GPP)
Duncan PW, Zorowitz R, Bates B, Choi JY, Glasberg JJ, Graham GD, Katz RC, Lamberty K, Reker D. Management of adult stroke rehabilitation care: a clinical practice guideline. Stroke, 2005;36:e117 -125	**Dysphagia Assessment** Recommend that all patients have their swallow screened before initiating oral intake of fluids or food, utilizing a simple valid bedside testing protocol. (B) Recommend that the swallow screening be performed by the SLP or other trained personnel (e.g. nurse or occupational therapist) if the SLP is not available. (I) A complete bedside swallowing examination, performed by the SLP, for all patients with abnormal swallowing screens. (I) Recommend that all patients who have a positive bedside screening be tested using a videofluoroscopy swallowing study (VFSS)/modified barium swallow. Patients with a high risk for aspiration and/or dysphagia (e.g. brain stem stroke, pseudobulbar palsy, and multiple strokes), regardless of screening results, should undergo VFSS. (B) Consider fiberoptic endoscopic examination of swallowing (FEES) as an alternative to VFSS. (C) Fiberoptic endoscopic examination of swallowing with sensory testing (FEESST) may be considered for the assessment of dysphagia. (I). VFSS and other diagnostic procedures for swallow should include assessment of treatment strategies. (B) **Dysphagia Treatment** Enteral feeding for patients who are unable to orally maintain adequate nutrition (B) Initiate swallowing treatment and management once SLP identifies a treatable disorder in swallow anatomy or physiology. (B) **Assessment of Malnutrition** Nutrition and hydration evaluation should be completed as soon as possible after admission, using a valid nutritional screening method. (I)

Guideline	Recommendations
	Use a variety of methods to maintain and improve intake of food and fluids. (I)
Intercollegiate Stroke Working Party. *National clinical guideline for stroke,* 4th edition. London: Royal College of Physicians, 2012.	**6.21 Swallowing problems: assessment and management** ***6.21.1 Recommendations*** A Until a safe swallowing method has been established, all patients with identified swallowing difficulties should: • be considered for alternative fluids with immediate effect • have a comprehensive assessment of their swallowing function undertaken by a specialist in dysphagia • be considered for nasogastric tube feeding within 24 hours • be referred for specialist nutritional assessment, advice and monitoring • receive adequate hydration, nutrition and medication by alternative means • be considered for the additional use of a nasal bridle if the nasogastric tube needs frequent replacement, using locally agreed protocols. B Any stroke patient unable to swallow food safely 1 week after stroke should be considered for an oropharyngeal swallowing rehabilitation programme designed and monitored by a specialist in dysphagia. This should include one or more of: • compensatory strategies such as postural changes (eg chin tuck) or different swallowing manoeuvres (eg supraglottic swallow) • restorative strategies to improve oropharyngeal motor function (eg Shaker headlifting exercises) • sensory modification, such as altering taste and temperature of foods or carbonation of fluids • texture modification of solids and/or liquids. C Every stroke patient who requires food or fluid of a modified consistency should: • be referred for specialist nutritional assessment • have texture of modified food or liquids prescribed using nationally agreed descriptors • have both fluid balance and nutritional intake monitored. D Stroke patients with difficulties self-feeding should be assessed and provided with the appropriate equipment and assistance (including physical help and verbal encouragement) to promote independent and safe feeding as far as possible. E All stroke patients with swallowing problems should have written guidance for all staff/carers to use when feeding or providing liquid. F Nutrition support should be initiated for people with stroke who are at risk of malnutrition which should incorporate specialist dietary advice and may include oral nutritional supplements, and/or tube feeding. G Instrumental direct investigation of oropharyngeal swallowing mechanisms (eg by videofluoroscopy or flexible endoscopic evaluation of swallowing) for stroke patients should only be undertaken: • in conjunction with a specialist in dysphagia • if needed to direct an active treatment/rehabilitation technique for swallowing difficulties, *or* • to investigate the nature and causes of aspiration. H Gastrostomy feeding should be considered for stroke patients who: • need but are unable to tolerate nasogastric tube feeding • are unable to swallow adequate amounts of food and fluid orally by 4 weeks • are at long-term high risk of malnutrition. I Any stroke patient discharged from specialist care services with continuing problems with swallowing food or liquid safely should:

Guideline	Recommendations
	• be trained, or have carers trained, in the identification and management of swallowing difficulties • should have regular reassessment of their dysphagia beyond the initial acute assessment to enable accurate diagnosis and management • should have their nutritional status and dietary intake monitored regularly by a suitably trained professional.

I. Dysphagia

Summary of Dysphagia Interventions and Associated Strength of Evidence from Selected Guideline Documents

i. Dysphagia Screening & Assessment

Recommendation	CBPR 2013	SIGN 118 2010	NSF 2010	VA/DoD 2010	AHA/ASA 2010	RCP 2012
Patients should be screened prior to p.o.intake using a valid tool	Using a valid tool [B]	-	B	-	B	Recommended
Screening should be completed within 24 hours.	B	-	GPP	-	-	-
Screening should be completed when clinically appropriate.	C	-	-	-	-	-
A bedside examination should be performed by an SLP for all patients who fail the screen	A	-	GPP	-	I	-
Patients who fail bedside assessment should receive an VMBS study	-	-	-	-	B	-
Patients at high risk of aspiration/or dysphagia should undergo a VMBS study, regardless of screening results	-	-	-	-	B	-
FEES may be used as an alternative to VMBS	-	-	GPP	-	C	-
FEESST may be used for the assessment of dysphagia	-	-	-	-	I	-

VMBS: videofluoroscopic modified barium swallow
FEES: fiberoptic endoscopic examination of swallowing
FEESST: fiberoptic endoscopic examination of swallowing with sensory testing

ii. Dysphagia Treatment

Intervention	CBPR 2013	SIGN 118 2010	NSF 2010	VA/DoD 2010	AHA/ASA 2010	RCP 2012
Swallowing rehabilitation program	A	B	B	B	B	Recommended
Diet modification	C	B	B	Recommended (No level of recommendation)	-	Recommended
Training of patient and caregivers in appropriate diet preparation and feeding techniques	-	-	GPP	Recommended (No level of recommendation)	-	Recommended (written guidance to caregivers and patients for fluid use)
Thermo tactile stimulation	-	-	C	-	-	-
Electrical stimulation	-	-	C	-	-	-
Therapy targeting specific muscle groups	-	-	C	-	-	-
Enteral feeding for patients unsafe with oral intake	Included	-	-	-	B	Recommended

GPP Good practice point

Evidence Tables

Dysphagia Screening and Assessment

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Middleton et al. 2011 **Australia** **Cluster RCT**	CA: ☑ Blinding: Patient ☑ Assessor ☑ ITT: ☑	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.	4,198 patients were randomized to receive care at institutions that had adopted treatment protocols to manage hyperglycemia, fever and swallowing dysfunction (FeSS intervention) or to a control facility. Clinicians at the participating control institutions received abridged guidelines only.	**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 vs. control group: Death or dependency at 90 days: 42% vs. 585, p=0.002 BI scores ≥95: 69% vs. 60%, p=0.07 Mean SF-36 (physical health): 45.6 vs. 42.5, p=0.002 Swallowing screening performed: 46% vs. 7%, p<0.0001 Pneumonia: 2% vs. 3%, p=0.82 Drop outs: n=48 at 90 days
Lakshminarayan et al. 2010 **USA** **Audit of National Stroke Registry**	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 Association's between screening status and incidence of pneumonia were explored using adjusted logistic regression	**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, 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**	NA	15 institutions in the US (73% with dedicated stroke units) collected data prospectively on patients discharged with a diagnosis of ischemic	Adherence rates between sites with formal dysphagia screening protocols and those without formal protocols were examined for	**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.

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
study		stroke.	differences in pneumonia rates		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
Regan et al. 2014 **Ireland** **Cochrane Review**	N/A	No randomized controlled studies met study eligibility criteria. **Inclusion criteria:** RCTs, assessing use of botulinum toxin for upper esophageal sphincter (UOS) dysfunction.	Selection criteria included studies that assessed the use of botulinum toxin for treatment of UOS after a neurological event or disease (including stroke and others such as TBI, Parkinson's disease, multiple sclerosis, etc.). Comparison groups could include different dosages, modes of delivery etc. of Botulinum toxin, placebo, other intervention, or traditional rehabilitation.	**Primary outcomes:** change in oral intake status, change in FEES (fibreoptic examination of swallowing safety), adverse events, patient are carer satisfaction. **Secondary outcomes:** reduction in the presence of residue, change in quality of life. **Assessment of outcomes:** classified as immediate, medium and long term (<1 month, 1-6 months, >6 months).	There is insufficient evidence to inform clinical practice. Methodological recommendations for RCTs assessing the effectiveness of botulinum toxin for the treatment of UOS are provided.
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: **Dysphagia** Acupuncture (5 RCTs), behavioral interventions (5 RCTs), drug therapy	**Primary outcome:** Death or dependency, death of disability (BI score of 0 to 55 or Rankin Scale score of 3 to 5) **Secondary outcomes:**	**Dysphagia outcomes** Case fatality at end of trial: No overall OR reported No significant treatment effect was associated with subgroup analysis by therapy type. Death or dependency at end of trial:

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
(Interventions for dysphagia and nutritional support)			(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), transcranial magnetic stimulation (1 RCT) **Nutrition** Routes of feeding (5 RCTs), Timing of feeding (1 RCT), fluid supplementation (1 RCT), nutritional supplementation (8 RCTs)	Case fatality at the end of the trial, neurological deterioration, late disability or dependency at the end of the trial, proportion with dysphagia at the end of the trial, improvement in dysphagia (assessed by videofluoroscopy, pharyngeal transit time, swallowing time, normal water swallow test, improvement in swallow function scales, functional oral intake scale (FOIS), Watian swallow scale, return to normal diet and fluids), aspiration: clinical, videofluoroscopy, pneumonia, gastrointestinal bleeding, feeding tube failures, nutritional measures (weight, albumin, mid-arm circumference [MAC]), LOS, pressure sores.	OR=1.05, 95% CI 0.63 to 1.75, p=0.86. Results from 2 trials included. LOS: MD=-2.70, -5.68 to 0.28. p=0.076. Results from 4 trials included. Chest infections or pneumonia No overall OR reported. No significant treatment effect was associated with subgroup analysis by therapy type (behavioral interventions, drug therapy, electrical stimulation) Dysphagia at end of trail: No overall OR reported. Significant treatment effect was associated with acupuncture and behavioral interventions. **Nutritional outcomes** Case fatality at end of trial (PEG vs. nasogastric tube): OR=0.81, 0.42 to 1.56, p=0.53. Results from 5 trials included. Death or dependency at end of trial (PEG vs. nasogastric tube): OR=0.80, 95% CI 0.12 to 5.55, p=0.82. Results from 3 trials included. Pressure sores (PEG vs. NG): OR=3.10, 95% CI 0.98 to 9.83, p=0.055. Results from a single trial included. Chest infection or pneumonia (PEG vs. NG): OR=0.65, 95% CI 0.23 to 1.86, p=0.42. Results from 2 trials included. Case fatality at end of trial (initiation of feeding <7 days vs. ≥7 days): OR=0.79, 95% CI 0.61 to 1.01, p=0.093. Results from 1 trial included.

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
					Death or dependency at end of trial (initiation of feeding <7 days vs. ≥7 days): OR=0.94, 95% CI 0.68 to 1.31, p=0.72 Case fatality at end of trial (nutritional supplementation vs. no supplementation) OR=0.58, 95% CI 0.28 to 1.21, p=0.14. Results from 7 trials included. Death or dependency at end of trial (nutritional supplementation vs. no supplementation) OR=1.06, 95% CI 0.94 to 1.20, p=0.33. Results from 1 trial included LOS (nutritional supplementation vs. no supplementation) MD=1.40, 95% CI -0.81 to 3.6, p=0.21. Results from 2 trials included.
Carnaby-Mann & Crary 2007 **USA** **Systematic review & meta-analysis** (NMES treatment)	NA	7 studies (255 patients) with orophyarygeal dysphagia secondary to stroke, cancer or other disease, without consideration to the timing of treatment intervention or the onset of dysphagia. Controlled (n=1) and uncontrolled studies (n=6) were included.	All studies evaluated treatment with NMES applied to the throat for swallowing rehabilitation + therapy. Treatment was provided daily for 1 hour in the majority of studies for 1 to 24 weeks.	Change in swallowing score assessed using the Mann Assessment of Swallowing Ability score, Functional Oral Intake Scale, and aspiration/penetration observed on VMBS examination, laryngeal elevation (cm)	SMD (Hedge's *g*)=0.66, 95% CI 0.47 to 0.85, p<0.001)
Park et al. 2013 **Korea** **RCT**	CA: ☑ Blinding: Patient ☑ Assessor ☒ ITT: ☒	18 patients with unilateral hemispheric stroke and oropharyngeal dysphagia lasting more than one month.	Patients were randomized into the intervention group (n=9) or control group (n=9). The experimental group (EG) received 5Hz rTMS over the contra-lesional pharyngeal motor cortex	**Outcomes**: Videofluoroscopic dysphagia scale (VDS) and Penetration- aspiration scale (PAS) scores. Outcomes were assessed before and after the intervention and at 2 weeks	Mean baseline VDS and PAS of EG was 33.6 ± 12.1 and 3.41 ± 2.32 respectively and the scores were reduced to 25.3 ± 9.8 and 1.93 ± 1.52 after 2 weeks of intervention (P < 0.05). This effect lasted for up to 2 weeks after treatment. However, there was no change in the CG. Baseline prevalence of aspiration, pharyngeal residue, delayed triggering of

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
			for 10 min per day for 2 weeks. The control group (CG) received sham stimulation under the same condition.	follow-up.	pharyngeal swallowing and abnormal pharyngeal transit time (PTT) in EG was 66.7%, 66.7%, 33.3%, and 44.4%, respectively. After rTMS, the prevalence of aspiration and pharyngeal residue was reduced to 33.3% and 33.3%, respectively. However, the prevalence of delayed triggering and abnormal PTT was not changed.
Xia et al. 2011 **China** **RCT** (NMES treatment)	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 Adverse events: No reporting
Kim et al. 2009 **Korea** **RCT**	CA: ☒ Blinding: Patient ☒ Assessor ☑	36 patients with post-stroke dysphagia admitted to a rehabilitation hospital. 6 patients were admitted >6 months post stroke	Patients were randomized to receive treatment with NMES using the VitalStim device + thermal tactile stimulation (TTS) or	**Outcomes:** Swallowing Function Scoring System (FSS)(0 to 6), Penetration Aspiration Scale (PAS) (1 to 8), pharyngeal transit time (sec) (PTT)	Median scores for patients in the experimental and control groups before and after treatment: FSS: 2 to 4 vs. 3 to 4, , $p<0.05$ PAS (semi-solid foods): 5.5 to 2.5 vs. 3.5 to 4,

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
(NMES treatment)	ITT: ☒	onset, the remainder were admitted <6 months.	NMES only for 4 weeks. For NMES treatment, the amplitude of the current level was approximately 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.	Assessments were conducted before and after treatment	p<0.05 PAS (liquid): 7 to 5 vs. 7 to 6.5, p<0.05 Mean ± sd scores for patients in the experimental and control groups before and after treatment : PTT (semi-solid): 0.97±0.18 to 0.86±0.18 vs. 0.97±0.19 to 0.96±0.19, p<0.05 PTT (liquids): 0.96±0.19 to 0.86±0.19 vs. 0.99±0.23 to 0.97±0.22, p<0.05 Drop outs: n=8 Adverse events: None
Carnaby et al. 2006 **USA** **RCT** (Behavioral intervention)	CA: ☑ Blinding: Patient ☒ Assessor ☑ ITT: ☑	306 patients with clinical-identified dysphagia admitted to hospital within 7 days of acute stroke, with no previous history of dysphagia	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 Drop outs and losses to follow-up: usual care n=23,

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
					low-intensity group n=21, high-intensity group n=19 Adverse events: No reporting
The FOOD trial 2005 **UK** **RCT** (part I- timing and method of feeding)	CA: ☑ Blinding: Patient ☒ Assessor ☑ ITT: ☑	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 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.	**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 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).
De Pippo et al. 1994 **USA** **RCT** (Dysphagia therapy)	CA: ☒ Blinding: Patient ☒ Assessor ☑ ITT: ☒	115 patients admitted to an inpatient rehabilitation unit an average of 5.6 weeks following confirmed stroke with VMBS evidence of dysphagia and failure on the Burke Dysphagia Screening Test	Patients were randomized to receive 1 of 3 treatment protocols: Group 1 (n=38) received one formal dysphagia treatment session and choice of modified-texture diet recommended by the SLP based on the results	**Primary outcome:** Pneumonia **Secondary outcome:** Dehydration, calorie-nitrogen deficit, recurrent upper-airway obstruction, death Patients were followed for	The number of patients meeting a study end point in groups 1, 2 and 3 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

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
			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.	the duration of their inpatient stay and for 1 year. Follow-up data was collected by telephone interview at 3,6 and 12 months	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 Drop outs: n=1 Adverse events: no reporting

II. Nutrition

Summary of Nutritional Interventions and Associated Strength of Evidence from Selected Guideline Documents

i. Screening/Assessment & Management of Malnutrition

Recommendation	CBPR 2010	SIGN 118 2010	NSF 2010	VA/DoD 2010	AHA/ASA 2010
Hydration/nutrition status of patients should be screened within the first 48 hours of admission using a valid tool.	Recommends (B)	-	B	Recommends	I
Referral to an RD if patients fail the screen	Recommends (C)	-	GPP	-	-
Texture-modified diet if recommended by the SLP	Recommends (C)	-	-	-	-
Enteral feeding if patients remain n.p.o. for>7 days	Recommends (C)	-	-	-	-
Malnourished or those at risk should be prescribed oral supplements as part of their care plan	-	C	-	A	-
Nasogastric feeding is preferred route of non-oral feeding during first -month	-	-	-	B	-
Use a variety of methods to maintain and improve intake of food and fluids		-			I
Food intake should be monitored for all patients		-		GPP	-

GPP Good practice point

Evidence Tables

Enteral Feeding

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
The FOOD trial 2005 (part I- timing and method of feeding) UK RCT	CA: ☑ Blinding: Patient ☒ Assessor ☑ ITT: ☑	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 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.	**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 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).

Oral Supplementation (Energy & Protein)

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
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 patients and patients at home with diabetic foot ulcer.	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 175and 1350 additional kcal/ Day and an additional 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)	**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 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: ☑ Blinding: Patient ☒ Assessor ☑ ITT: ☒	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	**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

			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.		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 Adverse events: No reporting
The FOOD trial 2005 **(part 2- oral supplementation)** **UK** **RCT**	CA: ☑ Blinding: Patient ☒ Assessor ☑ ITT: ☑	4,023 non-dysphagic patients admitted within 7 days of first or recurrent stroke. Clinician unsure whether to provide supplements (8% of patients malnourished at baseline)	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 of their entire hospital stay (median duration of hospital stay was 34 days- 28% of patients stopped taking supplements before discharge).	**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% CI -2.3 to 3.8. Mean difference in EROQoL scores between groups: 0.001, 95% CI -0.23 to 0.025, p>0.05 Losses to follow-up and drop-outs: n=26 (regular diet), n=245 (supplement) Adverse events: no significant differences in complications (pneumonia, urinary tract infections etc) between groups
Gariballa et al. 1998 **UK** **RCT**	CA: ☑ Blinding: Patient ☒ Assessor ☑ ITT: ☒	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 1200Kcals, 40g protein daily for 4 weeks.	**Primary outcome:** Change in nutritional status **Secondary outcomes:** Barthel Index, infective complications, death within 3 months and discharge location Outcomes were assessed at baseline, and weeks 2, 4 and 12.	Patients in the supplemented group consumed 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 Mean change (95% CI) from baseline for patients in supplement and control groups at week 12 Weight (kg): 0.2 (-1.1 to 1.4) vs. -0.7 (-2.7 to 1.4), p>0.05 Tricep skinfold; (mm) -0.9 (-1.9 to 0.1) vs. -0.6 (-1.5 to 0.4), p>0.05

					Mid-arm muscle circumference (cm): -0.3 (-0.9 to 0.3) vs. -0.3 (-1.2 to 0.7)p>0.05 Serum albumin (g/L):-1.5 (-3.1 to 0.1) vs. -4.4 (-6.6 to -2.3), p=0.025 Serum transferrin (g/L): 0.1 (-0.4 to 0.5) vs. -0.3 (-0.6 to 0.10, p>0.05 Iron (µmol/L): 2.6 (-1.5 to 6.7) vs. -2.7 (-5.6 to 0.2), p=0.03 Median (IQR) BI scores at baseline and week 12 for patients in the supplement and control groups 45 (20-49) to 90 (60-94) vs. 35 (16-49) to 75 (47-88), p>0.05 Number of infective complications: supplement group n=9, control group n=11, p>0.05 Death within 3 months: supplement group n=2, control group n=7, p=0.127 Losses to follow-up, n=11 Adverse events: None

Lifestyle Interventions Post-Stroke

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Kono et al. 2013 **Japan** **RCT**	CA: ☑ Blinding: Patient ☒ Assessor ☑ ITT: ☑	70 patients (48 men, mean age 63.5 years) with acute noncardioembolic mild ischemic stroke.	Patients were randomized to either 1) lifestyle modification group (n=35) or 2) advice-only group (n=35). Both the intervention and control group received advice and counselling for lifestyle modification (30-40 minute sessions,	**Primary outcomes:** death from stroke or cardiac disease, hospitalization due to any cardiovascular disease. **Secondary outcomes:** blood pressure, cholesterol, lipid levels, hemoglobin A1C, weight, BMI, C-reactive protein (hs-CRP).	Death or hospitalization from cardiovascular disease: Adjusted hazard ratio 0.194; 95% CI 0.121 – 0.737) *Note: study terminated early favoring the lifestyle intervention. There was a statistically significant decrease in salt intake for the intervention group compared to the control group (p = 0.018). There was a statistically significant improvement in blood pressure (Clinic and home systolic and

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
			at baseline, 3 months and 6 months). The intervention group also received an exercise training program and a salt reduction program (duration of 24 weeks with salt intake monitored every 6 weeks) The control group only received the 3 sessions of advice and counselling.		diastolic blood pressure p<0.001) and HDL-C (p=0.022) for the intervention group compared to the control group. There were no differences between the groups for weight, BMI, LDL or hs-CRP.

Pediatric Stroke

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Morgan et al. 2012 **Australia** **Cochrane Review**	N/A	Randomised controlled trials and quasi-randomised controlled trials for children with oropharyngeal dysphagia and neurological impairment.	Examining the effectiveness of interventions for oropharyngeal dysphagia in children with neurological impairment. *Neurological impairment including stroke but population % is not defined.	**Primary outcomes:** swallow functioning, presence of aspiration pneumonia or chest infection, diet consistency. **Secondary outcomes:** weight and height changes, level of participation during meals, carer stress.	Three RCTs met eligibility criteria; meta-analysis was not possible. The quality of studies in this field are a concern,

Glossary

RCT= Randomized Controlled Trial
N/A = Not Applicable
CA = Concealed Allocation
FEES = Fibreoptic Examination of Swallowing Safety
UOS = Upper Esophageal Sphincter
PEG = Percutaneous Endoscopic Gastronomy
NG = Nasogastric
BI = Barthel Index
ITT = Intention to treat
OR = Odds Ratio
SMD = Standardized Mean Difference
CI = Confidence Interval
IQR = Interquartile Range

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