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REVIEW

Dysphagia and Associated Pneumonia in Stroke Patients from Brazil: A Systematic Review

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Abstract

Dysphagia and its associated complications are expected to be relatively more frequent in stroke patients in Brazil than in similar patients treated in developed countries due to the suboptimal stroke care in many Brazilians medical services. However, there is no estimate of dysphagia and pneumonia incidence for the overall stroke population in Brazil. We conducted a systematic review of the recent literature to address this knowledge gap, first screening citations for relevance and then rating full articles of accepted citations. At both levels, judgements were made by two independent raters according to a priori criteria. Fourteen accepted articles underwent critical appraisal and data extraction. The frequency of dysphagia in stroke patients was high (59% to 76%). Few studies assessed pneumonia and only one study stratified patients by both dysphagia and pneumonia, with an increased Relative Risk for pneumonia in patients with stroke and dysphagia of 8.4 (95% CI 2.1, 34.4). Across all articles, we identified bias related to: heterogeneity in number and type of stroke; no rater blinding; and, assessments that were not reproducible, reliable or validated. Despite the high frequency of dysphagia and associated pneumonia in stroke patients in Brazil, the quality of the available literature is low and that there is little research focused on these epidemiologic data. Future rigorously designed studies are in dire need to accurately determine dysphagia incidence and its impact on stroke patients in Brazil. These data will be critical to properly allocate limited national resources that maximize the quality of stroke care.

Keywords Deglutition · Deglutition disorders · Dysphagia · Pneumonia · Stroke · Brazil

Introduction

Brazil has a high incidence of stroke (137 per 100,000 inhabitants per year) [1] compared to stroke rates worldwide [2]. Stroke is one of the leading causes of death and disability in this country [3–6], yet there is little focus on the control of risk factors for stroke among the Brazilian population [4, 7, 8], and access to treatments such as cerebral reperfusion therapy is restricted to few hospitals [5, 9]. Furthermore, across Brazil, the general population has limited knowledge about stroke as an urgent medical emergency and few healthcare professionals have specialized training in stroke [4, 10]. All these factors contribute to delays in hospital admission

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and consequently to the high mortality and disability due to stroke throughout Brazil [5, 10, 11].

In an effort to promote better stroke recovery, Brazilian stroke guidelines [12] have been developed to align with those in North American [13, 14] and in the United Kingdom (UK) [15]. Like their worldwide counterparts, these guidelines recommend timely cerebral reperfusion therapy for eligible patients, dysphagia screening as soon as the patient is awake and alert, and care from a dedicated multidisciplinary stroke team [13–15]. However, approximately only 1% of all patients with stroke admitted to a Brazilian public hospital receive reperfusion therapy and/or specialized care during their acute stay [6, 9, 16]. As a result, many stroke patients in Brazil continue to receive suboptimal stroke care and thus remain at high risk for post-stroke complications.

Dysphagia affects approximately half of the stroke patients [17–19] and contributes to pulmonary complications [17, 20–22]. The rate of pneumonia in stroke patients worldwide is around 14% [23], and of those stroke patients with dysphagia the risk for pneumonia is eight times greater [24]. Length of hospital stay in patients with stroke and dysphagia is up to 4 days longer than patients without dysphagia [25], and in-hospital mortality rate in dysphagic patients is around 11% to 16% [20, 26]. Due to the suboptimal stroke care in Brazil, it is expected that dysphagia and its associated pulmonary complications will be relatively greater than in similar patients treated in developed countries. However, to date, there is no estimate of dysphagia incidence for patients with stroke in Brazil [27]. This epidemiologic data point would be critical to allocate limited national resources that serve to maximize the quality of stroke care, and provide a benchmark for future research focused on interventions that reduce dysphagia and its negative impact on health. In a first effort to address this knowledge gap, our study conducted a systematic review of the literature on patients with stroke in Brazil with the aim to derive a country specific estimate of both dysphagia frequency and an associated risk for aspiration pneumonia.

Materials and Methods

Study Objectives

Our study was guided by the following objective: to identify the reported frequency of oropharyngeal dysphagia in stroke patients across the recovery continuum in Brazil. We also aimed to identify the reported frequency of pneumonia in stroke patients with and without oropharyngeal dysphagia in Brazil.

Our secondary aims were to assess the frequency of dysphagia according to various characteristics of stroke (i.e., type), dysphagia assessment (i.e., clinical versus instrumental), and time of dysphagia assessment post-stroke.

Operational Definitions

The following operational definitions were used in the search and determined a priori: *oropharyngeal dysphagia,* defined as any physiological impairment affecting the oral, pharyngeal and/or upper esophageal phases of swallowing; *pneumonia*, defined as any infection in one or both of the lungs (if pneumonia was reported, the criteria by which it was defined had to be declared); and *stroke*, defined as any confirmed diagnosis by medical and/or imaging exams and treated in acute, rehabilitation, or chronic facilities (public and/or private) and regardless of stroke type or location.

Search Strategy

We performed an extensive electronic search to identify relevant articles from all languages published using the databases Medline, Embase, PsycINFO, CINAHL, Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials, IBECS, Lilacs, and the Scientific Electronic Library Online (Scielo) from their start date to August 14th, 2017. The following terms were included and combined in each database as appropriate: "deglutition, deglutition disorders, swallowing, swallowing disorders, oropharyngeal, dysphagia, stroke, cerebrovascular diseases, Brasil and Brazil" (see Appendix for full search strategies).

Study Selection

Two independent raters reviewed all citations according to an a priori exclusion criteria, which included: no abstract; tutorials, narrative reviews, or study protocol; > 10% of patients were < 18 years; > 10% of patients had a diagnosis other than stroke; oropharyngeal dysphagia or aspiration were not reported outcomes; < 10 patients with stroke occurring in Brazil; and, conference proceedings. All selected abstracts went forward to full article review by the two independent raters where these and additional exclusion criteria were applied: not consecutive enrolment; no data to label presence/absence of dysphagia using a gold standard test (i.e., clinical assessment by SLP, videofluoroscopy (VFS) and/or Fiberoptic Endoscopic Evaluation of Swallowing (FEES); > 10% of patients with a diagnosis other than stroke; unclear raw data; and same data as an included study. Disagreements in abstract and full article ratings were resolved by consensus with a third rater.

Data Extraction

Only full articles that did not meet the exclusion criteria outlined above underwent data extraction. One rater extracted the data from each article and summarized the relevant data descriptively in tabular form. A second rater checked the accuracy of data extraction for each article. Disagreements were resolved by consensus.

Analysis of Risk of Bias

Each included article was assessed for Risk of bias according to Cochrane reviews methodology [28]. This included five main categories: Selection Bias, Performance Bias, Detection Bias, Attrition Bias, and Reporting Bias. One rater assessed all articles and a second rater checked the accuracy of risk data for each article. Disagreements were resolved by consensus.

Data Analysis

The frequency of dysphagia between the studies was derived according to characteristics of stroke, methods of assessment, and time of assessment post-stroke event using proportions. For studies that included pneumonia rates for those with/without dysphagia, we derived Relative Risks (RR) along with their 95% CI for the risk of developing pneumonia associated with dysphagia.

Results

Literature Retrieval

We identified 643 citations across all data sources. Duplicates were removed, the remaining 426 abstracts were screened, of which 79 were accepted for full article review. Of these articles, 65 did not meet our inclusion criteria and the remaining fourteen were included in our study (Fig. 1).

Study Characteristics

The study characteristics for all included articles are summarized in Table 1. The timing of dysphagia assessment post-stroke event varied across studies, with studies including patient within 48 h [29, 30] to more than 6 months after stroke [38].

Across all studies, the number of patients sampled per study ranged from 26 [32, 35, 37] to 212 patients [40]. Age of stroke patients ranged from 20 [33] to 94 years [30], with thirteen studies [27, 29–37, 39–41] reporting mean ages in the sixth decade.

The stroke characteristics varied across all studies. Namely, seven studies [27, 29, 30, 32, 33, 35, 40] included patients with both ischemic and hemorrhagic stroke, another four studies [31, 34, 37, 41] included only ischemic stroke and the remaining three studies [36, 38, 39] did not report the type of stroke.

Across all studies that utilized clinical assessment of dysphagia, all but one included bedside assessment by an SLP, utilizing a variety of food stimuli and scoring protocols (Table 1). The one exception [38] judged dysphagia presence according to a level of functional diet with a standardized tool, the Functional Oral Intake Scale - FOIS [42]. In additional to a clinical assessment, four studies [29, 31, 38, 39] used FEES to assess dysphagia, with three of them [29, 31, 39] using the Penetration-Aspiration Scale (score ≥ 6) and one study [38] using Macedo Filho Scale [43] to define the presence of aspiration (Table 1). Two other studies [27, 36] also administered videofluoroscopy, but it was done with dysphagic patients only, therefore, their data were not included.

Across all studies, the food consistencies used to assess the swallow varied, with most: studies [27, 30, 33, 34, 36, 38, 40, 41] utilizing solid, paste, and liquid. In addition to consistency, the volume per mouthful used in the assessments ranged from 3 mL [27, 30, 33, 40, 41] to 50 mL [30, 33]. Four other studies also included free or unrestricted volumes [29, 31, 40, 41].

Dysphagia presence was scored as clinical signs of risk for aspiration in three studies [31, 34, 35] and in five studies [27, 30, 33, 37, 40] they scored dysphagia as impairments in both oral and pharyngeal phase.

The co-occurrence of dysphagia and pneumonia was assessed in only four studies [31, 35, 37, 40]. One study [31] assessed pneumonia after 3 months of stroke and another study [35] in the first week of stroke. Two studies [37, 40] did not detail the time of pneumonia assessment. One study [35] assessed pneumonia with chest x-ray, another study [37] from patient report, and the two other studies [31, 40] did not report how they assessed pneumonia. No study declared an operational definition for pneumonia.

Critical Appraisal

Our critical appraisal of the accepted articles is summarized in Table 2. Of all 14 articles, four studies [33–35, 37] clearly included a homogenous sample of patients with either first time stroke and four studies [31, 34, 37, 41] included only ischemic stroke; the remaining studies introduced a risk for selection bias by including a mixed study population. Specifically, either selecting patients with mixed stroke events [30, 38–40] or not specifying number of strokes [27, 29, 31, 32,

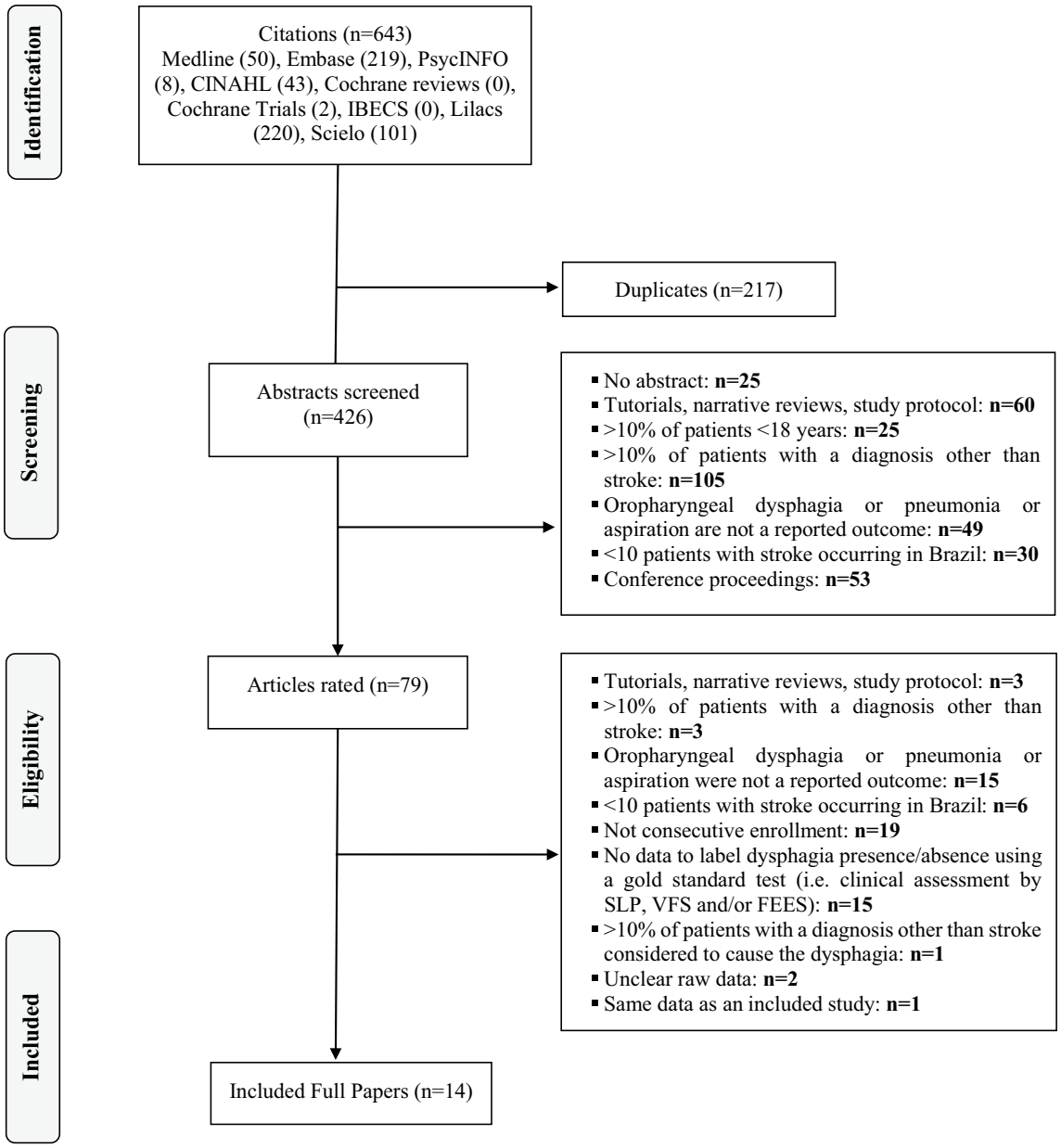

Fig. 1 Flow chart about included articles

36, 41]; or including both ischemic and hemorrhagic strokes [27, 29, 30, 32, 33, 35, 40]; or failing to report on type of stroke [36, 38, 39]. Only two studies [33, 35] reported on stroke severity.

Eleven of the fourteen studies [27, 29–33, 35–37, 39, 41] included patients with varying age. One study [38] introduced a risk for selection bias with only elderly patients (61–90 years), and the two other studies did not report age range [34, 40].

Two studies [34, 41] introduced a risk for detection bias because the clinicians who rated for presence of dysphagia were not blinded to stroke details, and the remaining studies were unclear about rater blinding. Eight studies [29–31, 33, 37–40] provided enough details regarding the dysphagia assessment method to ensure reproducibility. However, two of these studies [37, 40] did not use a previously validated method to score dysphagia.

Frequency of Dysphagia Identified from Clinical Assessment

The reported frequency of overall dysphagia identified by clinical assessment ranged from 32 [41] to 80% [40]. In studies that assessed patients within 72 h, the frequency of

Table 1 Study characteristics and frequency of dysphagia using clinical or instrumental assessment

Study	N	Study design	Eligibility criteria	Mean age ± SD (range)	Gender, n (%)	First only, multiple only, or mixed stroke events; Stroke type; Sites involved; Stroke severity	Assessment type performed in dysphagic and non-dysphagic patients[a]	Consistency and volume	How scored	First assessment following stroke	Dysphagia and/or Aspiration[b] n (%)
Dysphagia assessed within 72 h post stroke											
Jacques et al. [32]	26	Prospective cross sectional	Stroke inpatients; clinically stable	63 ± 12.9 (48–77)	Male: 14 (53.8) Female: 12 (46.2)	NR Mixed Mixed NR	Clinical by a SLP (AFDN, 2004)	NR	NR	2.7 mean days	No dysphagia: 15 (57.7) Dysphagia overall: 11 (42.3)
Nunes et al. [29]	30	Prospective cross sectional	Responsive to the examination; clinically stable; Glasgow Coma Scale > 11	60.6 ± 15 (30–86)	Male: 18 (60) Female: 12 (40)	NR Mixed Mixed NR	Clinical by a SLP FOIS (Crary et al. [42]) FEES (Rosenbek et al. [52])	Solid Paste Liquid Nectar Honey (5 mL, 10 mL, free volume)	FOIS, 7-point scale, where 7 = normal PAS, 8-point ordinal scale	≤48 h	FOIS Level 1 = 5 (16.7) Level 2 = 0 Level 3 = 1 (3.3) Level 4 = 0 Level 5 = 3 (10) Level 6 = 1 (3.3) Level 7 = 20 (66.7) Aspiration Paste = 4 (13) Liquid = 6 (20) Nectar = 3 (10) Honey = 4 (13)

Table 1 (continued)

Study	N	Study design	Eligibility criteria	Mean age ± SD (range)	Gender, n (%)	First only, multiple only, or mixed stroke events; Stroke type; Sites involved; Stroke severity	Assessment type performed in dysphagic and non-dysphagic patients[a]	Consistency and volume	How scored	First assessment following stroke	Dysphagia and/or Aspiration[b] n (%)
Pinto et al. [31]	52	Prospective cohort	Age > 18; clinically stable; Glasgow Coma Scale ≥ 10	62 ± 13.9 (NR)	Male: 29 (55. 8) Female: 23 (44.2)	NR Ischemic NR NR	Clinical by a SLP FOIS (Crary et al. [42]) FEES (Rosenbek et al. [52])	Paste Liquid Nectar Honey (5 mL, 10 mL, free sip)	Dysphagia: clinical signs of aspiration FOIS, 7-point scale, where 7 = normal PAS, 8-point ordinal scale	≤72 h	No dysphagia: 30 (57.7) Dysphagia overall:22 (42.3) FOIS Level 1 = 13 (25) Level 2 = 1 (1.7) Level 3 = 1 (1.7) Level 4 = 2 (4) Level 5 = 5 (9.5) Level 6 = 2 (4) Level 7 = 28 (53.9) No aspiration: 34 (65.4) Aspiration overall: 18 (34.6) Aspiration: Paste = 14 (27) Liquid = 17 (33) Nectar = 13 (25) Honey = 12 (23)

Table 1 (continued)

Study	N	Study design	Eligibility criteria	Mean age ± SD (range)	Gender, n (%)	First only, multiple only, or mixed stroke events; Stroke type; Sites involved; Stroke severity	Assessment type performed in dysphagic and non-dysphagic patients[a]	Consistency and volume	How scored	First assessment following stroke	Dysphagia and/or Aspiration[b] n (%)
Mourão et al. [30]	100	Prospective cohort	Acute stroke with or without dysphagia and language disorder	62.6 ± 16.7 (13–94)	Male: 46 (46) Female: 54 (54)	Mixed Mixed Mixed NR	Clinical by a SLP GUSS (Trapl et al. [53])	Solid Paste Liquid (3 mL to 50 mL)	GUSS: 20-point score, where 20 = normal	≤48 h	No dysphagia: 48 (48) Dysphagia overall[c] 52 (52) Dysphagia Slight = 12 (12) Dysphagia Moderate = 12 (12) Dysphagia Severe = 28 (28)
Dysphagia assessed within 10 days post stroke											
Schelp et al. [27]	102	Prospective cross sectional	Stroke within 72 h; conscious; clinically stable	62.2 (32–92)	Male[d]:66 (68.7) Female: 30 (31.3)	NR Mixed NR NR	Clinical by a SLP	Solid Paste Liquid (3 mL to 10 mL)	Dysphagia: impairments in oral and/or in pharyngeal phase	6 median days (0–31)	No dysphagia: 24 (23.5) Dysphagia overall:78 (76.5) Dysphagia Mild = 44 (56.4) Dysphagia Moderate = 29 (37.2) Dysphagia Severe = 5 (6.4)
Barros et al. [34]	27	Prospective cross sectional	Age > 18; first ischemic stroke; acute phase	60 (NR)	Male: 15 (56) Female: 12 (44)	First Ischemic Mixed NR	Clinical by a SLP	Solid Paste Liquid (volume NR)	Dysphagia: presence of clinical signs of penetration or aspiration	Between 2 and 9 days	No dysphagia: 14 (52) Dysphagia overall: 13 (48)

Table 1 (continued)

Study	N	Study design	Eligibility criteria	Mean age ± SD (range)	Gender, n (%)	First only, multiple only, or mixed stroke events; Stroke type; Sites involved; Stroke severity	Assessment type performed in dysphagic and non-dysphagic patients[a]	Consistency and volume	How scored	First assessment following stroke	Dysphagia and/or Aspiration[b] n (%)
Marques et al. [35]	26	Prospective cohort	Hospital admission within 7 days of onset from a first stroke; conscious	63.5 ± 12.4 (NR)	Male: 15 (57.7) Female: 11 (42.3)	First Mixed Mixed Scandinavian Stroke Scale (SSS) score 27.7 ± 9	Clinical by a SLP SSA for liquid (Ellul et al. [54]); adapted protocol for paste	Paste Liquid (volume NR)	Binary (Pass/fail); Risk for laryngeal penetration: Wet voice or a reduction ≥ 2% in SpO_2	3.1 ± 1.6 mean days	Dysphagia: Paste = 7 (27) Liquid = 20 (77)
Diniz et al. [39]	19	Prospective Randomized Control Trial	Clinically stable and conscious, with nasogastric tube[e]	63.4 ± 13.3 (31–92)	Male: 40 (65.6) Female: 21 (34.4)	Mixed NR NR NR	FEES (Rosenbek et al. [52])	Paste: (2.5 mL with volume being adapted to functional levels until 7 0 mL had been ingested) Liquid: (2 × of: 5 mL, 10 mL, 20 mL)	PAS, 8-point ordinal scale	Acute phase: 4 median days (3–7 days)	No dysphagia: 8 (42.1) Dysphagia overall: 11 (57.9) No aspiration:12 (63.2) Aspiration overall: 7 (36.8)
Baroni et al. [40][f]	172	Prospective[g]	Patients with or without swallowing complaints; able to be assessed	GI: without dysphagia (62) GII: with dysphagia (65) (NR)	GI: Male: 46 (59) Female: 32 (41) GII: Male: 79 (59) Female: 55 (41)	Mixed Mixed Mixed NR	Clinical by a SLP (Silva [55]) Blue dye test for patients with tracheostomy (O'Neil-Pirozzi [56])	Solid Paste Liquid (3, 5, 7 mL and free volume)	Dysphagia:1 or + impairments in oral and/or pharyngeal phase	≤5 days	No dysphagia: 70 (40.7) Dysphagia overall: 102 (59.3)

Table 1 (continued)

Study	N	Study design	Eligibility criteria	Mean age ± SD (range)	Gender, n (%)	First only, multiple only, or mixed stroke events; Stroke type; Sites involved; Stroke severity	Assessment type performed in dysphagic and non-dysphagic patients[a]	Consistency and volume	How scored	First assessment following stroke	Dysphagia and/or Aspiration[b] n (%)
Otto et al. [33]	42	Prospective cross sectional	First stroke	65.7 ± 14.4 (20–86)	Male:20 (47.6) Female: 22 (52.4)	First Mixed Mixed NIHSS 0–6: 17 (40.5) 7–15: 16 (38.1) ≥16: 9 (21.4)	Clinical by a SLP GUSS (Trapl et al. [53]) FOIS (Crary et al. [42])	Solid Paste Liquid (3 mL to 50 mL)	GUSS: 20-point score, where 20 = normal) FOIS, 7-point scale, where 7 = normal	4 ± 1.9 mean days (≤7 days)	No dysphagia: 10 (23.8) Dysphagia overall: 32 (76.2) Dysphagia Mild = 5 (11.9) Dysphagia Moderate = 10 (23.8) Dysphagia Severe = 17 (40.5) FOIS Level 1 = 16 (38.1) Level 2 = 2 (4.8) Level 3 = 0 Level 4 = 1 (2.4) Level 5 = 7 (16.7) Level 6 = 7 (16.7) Level 7 = 9 (21.4)

Table 1 (continued)

Study	N	Study design	Eligibility criteria	Mean age ± SD (range)	Gender, n (%)	First only, multiple only, or mixed stroke events; Stroke type; Sites involved; Stroke severity	Assessment type performed in dysphagic and non-dysphagic patients[a]	Consistency and volume	How scored	First assessment following stroke	Dysphagia and/or Aspiration[b] n (%)
Dysphagia assessed more than 10 days post stroke											
Xerez et al. [36]	37	Prospective cross sectional	Stroke in a period of 30 to 365 days	60 ± 13 (22–81)	Male: 20 (54) Female: 17 (46)	NR	Clinical by a SLP	Solid Paste Liquid (volume NR)	NR	104.3 ± 97.5 mean days	No dysphagia: 9 (24.3) Dysphagia overall: 28 (75.7) Dysphagia Mild = 11 (29.7) Dysphagia Moderate = 10 (27) Dysphagia severe = 7 (18.9)
Diniz et al. [39]	19	Prospective Randomized Control Trial	Clinically stable and conscious, with nasogastric tube[h]	63.4 ± 13.3 (31–92)	Male: 40 (65.6) Female: 21 (34.4)	Mixed NR NR NR	FEES (Rosenbek et al. [52])	Paste: (2.5 mL with volume being adapted to functional levels until 70 mL had been ingested) Liquid: (2 × of: 5 mL, 10 mL, 20 mL)	PAS, 8-point ordinal scale	150 median days (9 days-4.9 years	No dysphagia: 16 (38.1) Dysphagia overall: 26 (61.9) No aspiration: 25 (59.5) Aspiration overall: 17 (40.5)

Table 1 (continued)

Study	N	Study design	Eligibility criteria	Mean age ± SD (range)	Gender, n (%)	First only, multiple only, or mixed stroke events; Stroke type; Sites involved; Stroke severity	Assessment type performed in dysphagic and non-dysphagic patients[a]	Consistency and volume	How scored	First assessment following stroke	Dysphagia and/or Aspiration[b] n (%)
Silva et al. [37]	26	Prospective[i]	First episode of stroke < 2 months	62 (26–83)	NR	First Ischemic NR NR	Clinical by a SLP (Silva et al. [57])	Paste Liquid (5 mL)	Dysphagia: impairments in bolus preparation and presence of clinical signs of aspiration	Between 25 days and 2 months	Dysphagia: - Impairments in bolus preparation Paste = 11 (42) Liquid = 7 (27) - Signs of aspiration Paste = 4 (15) Liquid = 3 (12)
Baroni et al. [40]	40	Prospective	Patients with or without swallowing complaints; able to be assessed	GI: without dysphagia (62) GII: with dysphagia (65) (NR)	GI: Male:46 (59) Female: 32 (41) GII: Male: 79 (59) Female: 55 (41)	Mixed Mixed Mixed NR	Clinical by a SLP (Silva [55]) Blue dye test for patients with tracheostomy (O'Neil-Pirozzi [56])	Solid Paste Liquid (3, 5, 7 mL and free volume)	Dysphagia: 1 or + impairments in oral and/or pharyngeal phase	> 5 and ≤ 60 days	No dysphagia: 8 (20) Dysphagia overall: 32 (80)

Table 1 (continued)

Study	N	Study design	Eligibility criteria	Mean age ± SD (range)	Gender, n (%)	First only, multiple only, or mixed stroke events; Stroke type; Sites involved; Stroke severity	Assessment type performed in dysphagic and non-dysphagic patients[a]	Consistency and volume	How scored	First assessment following stroke	Dysphagia and/or Aspiration[b] n (%)
Dysphagia assessed more than 6 months post stroke											
Mituuti et al. [38]	30	Prospective cross sectional	Age > 60; stroke ≥ 6 m; no dysphagia rehabilitation stable health; able to perform tests	73 ± 8.6 (61–90)	Male: 15 (50) Female: 15 (50)	Mixed NR Mixed NR	FOIS (review of usual food consumption in the 24-hour dietary recall) (Crary et al. [42]) FEES (Macedo Filho [43])	Solid Paste Liquid (10 mL)	FOIS, 7-point scale, where 7 = normal 4-point score, where 0 = normal)	37.7 ± 27.1 mean months	FOIS: Level 1 = 0 Level 2 = 0 Level 3 = 0 Level 4 = 10 (34) Level 5 = 16 (53) Level 6 = 0 Level 7 = 4 (13) Dysphagia: Paste = 16 (53) Liquid = 25 (83) Solid = 17 (57
Time of assessment not reported											
Okubo et al. [41]	50	Prospective cross sectional	Stroke within 48 h; age > 18; without history of swallowing difficulties	65 (26–91)	Male: 25 (50) Female:25 (50)	NR Ischemic Mixed NR	Clinical by a SLP	Solid Paste Liquid (3 mL, 5 mL, 7 mL, free volume)	NR	NR	No dysphagia: 34 (68) Dysphagia overall: 16 (32)

[a]Data for assessments administered to unselected patients only

[b]Penetration-Aspiration Scale (score ≥ 6) to define the presence of aspiration

[c]Data captured at baseline only

[d]Data from 96 patients only

[e]Confirmed by authors that nasogastric tube insertion was standard practice regardless of dysphagia presence

[f]Albeit unclear, we assumed that < 10% of patients had a tracheotomy

[g]Unclear if a cohort or cross sectional study design

[h]Confirmed by authors that nasogastric tube insertion was standard practice regardless of dysphagia presence

[i]Unclear if a cohort or cross sectional study design

FOIS Functional Oral Intake Scale, *GUSS* Gugging Swallowing Screen, *NR* not reported, *SSA* Standardized Bedside Swallowing Assessment

Table 2 Critical appraisal of articles reviewed

	Schelp et al. [27]	Xerez et al. [36]	Barros et al. [34]	Marques et al. [35]	Diniz et al. [39]	Silva et al. [37]	Jacques et al. [32]
Selection bias							
1. Was the sample representative of first time stroke?	?	?	+	+	–	+	?
2. Was the sample representative of stroke in terms of severity?	?	?	?	+	?	?	?
3. Was the sample representative of one specific type of stroke?	–	?	+	–	?	+	–
4. Was the sample representative of different stroke lesion sites?	?	?	+	+	?	?	+
5. Was the sample representative of different age range?	+	+	?	+	+	+	+
Performance bias							
1. Were the raters blinded to medical information about stroke?	?	?	–	?	?	?	?
Detection bias–dysphagia							
1. Was the method of assessment reproducible?	–	–	–	–	+	+	–
2. Was the method of assessment reliable?	–	–	–	–	+	–	–
3. Was the method of assessment validated?	–	–	–	–	+	–	–
4. Were the raters blinded to each other's assessment results, when applicable?	n/a	?	n/a	n/a	+	?	n/a
5. Was the surveillance timeline was the same for all patients?	–	–	–	–	–	–	–
Detection bias–pneumonia							
1. Was the method of assessment reproducible?	n/a	n/a	n/a	–	n/a	–	n/a
2. Was the method of assessment reliable?	n/a	n/a	n/a	?	n/a	?	n/a
3. Was the method of assessment validated?	n/a	n/a	n/a	?	n/a	?	n/a
4. Were the raters blinded to dysphagia assessment results?	n/a	n/a	n/a	?	n/a	?	n/a
5. Was the surveillance timeline was the same for all patients?	n/a	n/a	n/a	+	n/a	?	n/a
Attrition bias							
1. Were all patients included in the analysis?	+	+	+	+	+	+	+
2. Were losses and exclusions reported with reasons?	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3. Were incomplete outcome data adequately addressed?	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Reporting bias							
1. Were all pre-specified outcomes reported?	+	+	+	+	+	+	+
2. Was the protocol utilized for all patients?	+	+	+	+	+	+	+
3. One or more reported outcomes were not pre-specified?	–	–	–	–	–	–	–

	Baroni et al. [40]	Nunes et al. [29]	Okubo et al. [41]	Pinto et al. [31]	Mituuti et al. [38]	Otto et al. [33]	Mourão et al. [30]
Selection bias							
1. Was the sample representative of first time stroke?	–	?	?	?	–	+	–
2. Was the sample representative of stroke in terms of severity?	?	?	?	?	?	+	?
3. Was the sample representative of one specific type of stroke?	–	–	+	+	?	–	–
4. Was the sample representative of different stroke lesion sites?	+	+	+	?	+	+	+
5. Was the sample representative of different age range?	?	+	+	+	–	+	+
Performance bias							
1. Were the raters blinded to medical information about stroke?	?	?	–	?	?	?	?
Detection bias–dysphagia							
1. Was the method of assessment reproducible?	+	+	–	+	+	+	+

Table 2 (continued)

	Baroni et al. [40]	Nunes et al. [29]	Okubo et al. [41]	Pinto et al. [31]	Mituuti et al. [38]	Otto et al. [33]	Mourão et al. [30]
2. Was the method of assessment reliable?	−	+	−	+	+	+	+
3. Was the method of assessment validated?	−	+	–	+	+	+	+
4. Were the raters blinded to each other's assessment results, when applicable?	n/a	n/a	n/a	?	?	n/a	n/a
5. Was the surveillance timeline was the same for all patients?	−	+	?	+	−	−	+
Detection bias–pneumonia							
1. Was the method of assessment reproducible?	−	n/a	n/a	–	n/a	n/a	n/a
2. Was the method of assessment reliable?	?	n/a	n/a	?	n/a	n/a	n/a
3. Was the method of assessment validated?	?	n/a	n/a	?	n/a	n/a	n/a
4. Were the raters blinded to dysphagia assessment results?	?	n/a	n/a	?	n/a	n/a	n/a
5. Was the surveillance timeline was the same for all patients?	?	n/a	n/a	+	n/a	n/a	n/a
Attrition bias							
1. Were all patients included in the analysis?	+	+	+	+	+	+	+
2. Were losses and exclusions reported with reasons?	n/a	n/a	n/a	n/a	n/a	n/a	+
3. Were incomplete outcome data adequately addressed?	n/a	n/a	n/a	n/a	n/a	n/a	+
Reporting bias							
1. Were all pre-specified outcomes reported?	+	+	+	+	+	+	+
2. Was the protocol utilized for all patients?	+	+	+	+	+	+	+
3. One or more reported outcomes were not pre-specified?	−	−	−	−	−	−	−

Yes (+), No (−), Unclear (?), not applicable (n/a)

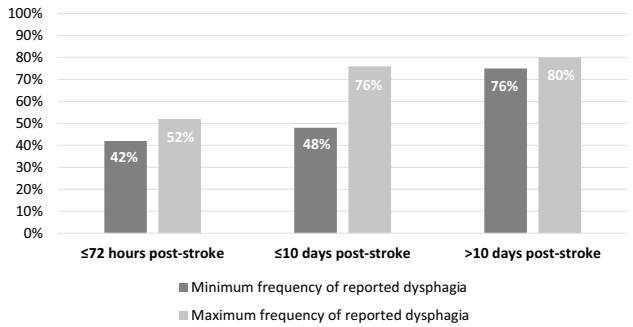

Fig. 2 Range in the frequency of dysphagia according to time of clinical swallowing assessment post-stroke

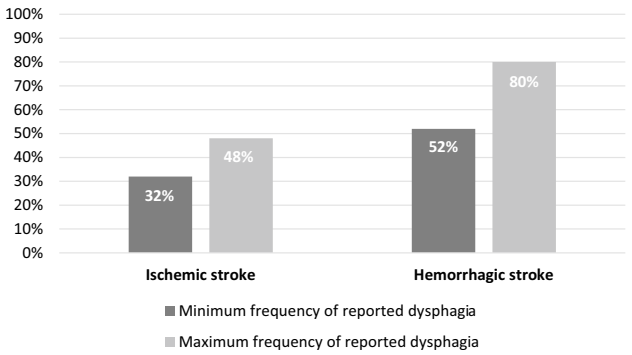

Fig. 3 Range in the frequency of dysphagia according to stroke type

dysphagia ranged from 42 [31] to 52% [30] and between studies that assessed within 10 days post-stroke this frequency ranged from 48 [34] to 76% [27, 35]. The frequency was higher in studies that assessed also patients with more than 10 days post-stroke, which ranged from 76 [36] to 80% [40] (Fig. 2).

In studies that included only patients with ischemic stroke, the frequency of overall dysphagia was lower than in studies that also included also hemorrhagic stroke, ranging between 32 [41] and 48% [34] versus 52% [30] to 80% [40], respectively (Fig. 3). In studies that included patients with only first stroke, the reported frequency of dysphagia was also lower than in studies that included patients with mixed

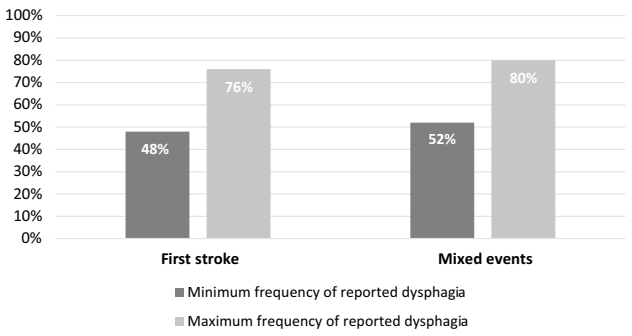

Fig. 4 Range in the frequency of dysphagia according to first stroke or mixed events

stroke events, ranging between 48% [34] and 76% [33] versus 52% [30] to 80% [40], respectively (Fig. 4). Finally, in studies that scored dysphagia broadly capturing both oral and pharyngeal phase impairments, the frequency of overall dysphagia was higher than in studies that scored dysphagia based on pharyngeal phase only, ranging between 52 [30] to 80% [40] versus 42% [31] to 48% [34], respectively.

Across studies with similar design and patient inclusion [27, 33, 40], such as those with acute patients with mixed stroke types and assessing dysphagia broadly using paste, liquid, and solid food consistencies, the frequency of dysphagia on clinical assessment ranged from 59 [40] to 76% [27, 33].

Frequency of Dysphagia Identified from Instrumental Assessment

Across the studies that utilized instrumental assessment for dysphagia, reported frequencies varied by operational definition for dysphagia and the food consistency. A broad definition of dysphagia in one study [39] reported a frequency of 58% in acute patients and of 62% in chronic patients. A narrow definition of dysphagia that is referring only to aspiration was utilized in two studies, which then reported a dysphagia frequency between 35 [31] to 40% [39].

Frequency of Pneumonia

The frequency of pneumonia ranged between none [35] to 15% [40]. In the study that assessed pneumonia within the first week of stroke [35] no patient presented with pneumonia. The three other studies [31, 37, 40] reported a frequency of pneumonia at 5.7%, 3.6%, and 15%, respectively. Of these, only one study [40] stratified patients by both dysphagia and pneumonia and reported that 22% of patients with stroke and dysphagia presented pneumonia and only 2% of patients with stroke and no dysphagia had pneumonia. Using these data, we derived an increased Relative Risk for pneumonia in patients with stroke and dysphagia of 8.4 (95% CI 2.1, 34.4) versus the same patients with stroke and no dysphagia.

Discussion

This is the first systematic review about dysphagia and associated pneumonia in stroke patients specific to Brazil. Our findings identified few studies that met our inclusion criteria, but within these studies identified dysphagia was reportedly a common consequence in patients with stroke in Brazil. These data highlight the importance of implementing strategies to manage dysphagia in this population to avoid complications. Unfortunately, the methodological quality of the available literature is fraught with potential risks for bias across several categories; thereby, limiting both the internal and external validity of these frequency estimates.

Across the included studies, reported frequencies varied by select study characteristics, namely: time of assessment post-stroke, stroke type, number of stroke events, and operational definition for dysphagia. Dysphagia frequency was lower in studies evaluating patients early post-stroke [29–32] compared to studies evaluating dysphagia 72 h or later post-stroke [27, 33–35], likely because the studies that assessed swallowing early did not include patients with more severe stroke. Unfortunately, these studies did not report the severity of stroke at the time of swallowing evaluation, which precludes objective assessment of frequency by stroke severity and tie of assessment. Likewise, we identified differences in reported frequency of dysphagia by stroke type, in that those with ischemic stroke [31, 34, 37, 41], lower rates than studies with mixed stroke types [27, 29, 30, 32, 33, 35, 40]. These findings align with others that have shown higher dysphagia rates with hemorrhagic stroke [18, 44]. Our findings also identified lower dysphagia frequency in studies with first stroke [31, 34] when compared to studies with mixed stroke [30, 40] and are supported by other studies that have shown higher dysphagia rates with mixed stroke events [45, 46].

Our results showed that the reported frequency of overall dysphagia varied by how dysphagia was assessed. Specifically, dysphagia rates were lower in studies that utilized only clinical signs of aspiration [31, 34]. Likewise, assessments that did not capture the entire oropharyngeal swallow physiology were also lower and likely underestimated dysphagia frequency [17]. The clinical swallow assessment alone will likely underestimate dysphagia presence as it may miss silent aspiration events [47, 48]. Yet, only few of our included studies used instrumental exams to assess the frequency of dysphagia [29, 31, 38, 39]. This is likely a reflection of the current limitation in most Brazilian medical services for the assessment of dysphagia [40]. However, interestingly of the few studies we identified that utilized instrumental exams, our findings showed a higher rate for overall dysphagia of any type (58% to 62%) compared to the rate for dysphagia restricted to be defined as aspiration alone (35% to 40%), a contrast that aligns with findings from other studies outside of Brazil [17].

The estimate of dysphagia in patients with stroke identified in the Brazilian studies (between 59 and 76%) is higher than the estimate reported in studies from developed countries included in the systematic review from Martino et al. [17], 51-55%, and than the frequency of dysphagia identified in studies of cohorts from developed countries such as Spain [26], Canada [20], and Italy [18], 47%, 45%, and 50%, respectively. The estimate identified in this systematic

review is also higher than some studies in emerging countries such as South Africa (53%) [49] and India (42%) [50].

The rate of pneumonia reported in a Brazilian cohort study was 15% [40], which is like the rate of pneumonia worldwide, and is interestingly lower than the rate of other emerging countries such as Chile (23%) [51] and India (32%) [50]. Although the presence of pneumonia is a known complication in stroke patients with dysphagia [17], only one [40] of our included studies assessed this association. Their findings showed that the risk for pneumonia in stroke patients with dysphagic was 8.4 (95% CI 2.1, 34.4) times higher than in similar patients without dysphagia. This estimated risk is higher than that for stroke patients in studies from developed countries reported in the systematic review from Martino et al. [17], which have a risk 3.2 (95% CI 2.1, 4.9); but it is similar to estimated risk of pneumonia reported in a recent systematic review from Eltringham et al. [24], which found a risk 8.5 (95% CI 5.6, 13). Unfortunately, this increased pneumonia risk related to the Brazilian literature could only be derived from this one study as the other studies with pneumonia data [31, 35, 37] did not report its presence according to dysphagia. Furthermore, pneumonia was not operationally defined any of these four studies, limiting the validity of the findings.

As with all systematic reviews, our study findings are limited by the quality of the original studies. Specifically, these studies did not provide details that are known to impact dysphagia presence, such as: stroke type [36, 38, 39]; first time or mixed stroke (multiple stroke events) [27, 29, 31, 32, 36, 41]; sites involved [27, 31, 36, 37, 39]; stroke severity [27, 29–32, 34, 36–41] and time of assessment [41]; food consistency and volume used [32]; and how dysphagia [32, 36, 41] or pneumonia [31, 35, 37, 40] were defined. Furthermore, these studies presented with a potential risk for detection bias because: dysphagia was rated subjectively and without tools with adequate psychometric validation [27, 32, 34–37, 40, 41]; and there was no blinding of dysphagia raters to stroke details [34, 41]. These methodological flaws can contribute to errors that overestimate or underestimate dysphagia and associated pneumonia frequencies due to rater subjectivity or missed events [49].

Despite the low number of Brazilian studies that met the selection criteria for this systematic review, it is important to highlight that there is a great interest in research on stroke and dysphagia in Brazil, considering the high number of conference proceedings and tutorials/narratives identified.

In conclusion, and despite methodological weaknesses in the literature, this systematic review highlights the high incidence of dysphagia and associated pneumonia in stroke patients in Brazil. These data are important for health service managers who promote strategies for early detection and adequate dysphagia care. Our study further shows that the quality of the available literature is low and that there is little research focused on stroke patients in Brazil and the rates of dysphagia and associated pneumonia. Future properly designed studies focused on stroke, dysphagia, and their concomitant risk for aspiration pneumonia will be critical to accurately inform future up-dates of Brazilian stroke guidelines and ultimately optimize dysphagia care in patients with stroke.

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Author Contributions The authors participated sufficiently in the work to take public responsibility for appropriate portions of the content.

Compliance with Ethical Standards

Conflict of interest The authors declared no potential conflicts of interest with respect of the research, authorship, and publication of this article.

Research Ethics Committee and Informed Consent All studies included in this systematic review involving human subjects declared that they were performed after approval by the appropriate Research Ethics Committee and that the written informed consent was obtained from all participants.

Appendix

See Table 3.

Table 3 Electronic search strategies

Database	Search strategy
Ovid MEDLINE 1946–August 14th, 2017	1 Deglutition Disorders/ 2 dysphag*.mp. 3 deglut*.mp. 4 swallow*.mp. 5 swalow*.mp. 6 aspirat*.mp. 7 1 or 2 or 3 or 4 or 5 or 6 8 exp Stroke/ 9 Cerebrovascular Disorders/ 10 exp Basal Ganglia Cerebrovascular Disease/ 11 exp Brain Ischemia/ 12 exp Brain Infarction/ 13 exp Hypoxia–Ischemia, Brain/ 14 exp Intracranial Arterial Diseases/ 15 Intracranial Arteriovenous Malformations/ 16 exp Intracranial Embolism/ 17 exp Intracranial Thrombosis/ 18 Vasospasm, Intracranial/ 19 Vertebral Artery Dissection/ 20 Aneurysm, Ruptured/ 21 Brain Injuries/ 22 exp Carotid Arteries/ 23 exp Intracranial Hemorrhages/ 24 stroke.mp. 25 cerebrovascular dis*.mp. 26 brain ischem*.mp. 27 brain hemorrhag*.mp. 28 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 29 exp Brazil/ 30 bra#il*.mp. 31 bra#il*.in. 32 bra#il*.cp. 33 29 or 30 or 31 or 32 34 7 and 28 and 33
Embase Classic + Embase 1947–August 14th, 2017	1 exp dysphagia/ 2 dysphag*.mp. 3 deglutit*.mp. 4 swallow*.mp. 5 swalow*.mp. 6 aspirat*.mp. 7 1 or 2 or 3 or 4 or 5 or 6 8 exp cerebrovascular accident/ 9 exp cerebrovascular disease/ 10 exp basal ganglion hemorrhage/ 11 exp brain ischemia/ 12 exp brain infarction/ 13 exp brain hypoxia/ 14 exp cerebral artery disease/ 15 exp brain arteriovenous malformation/ 16 exp brain embolism/ 17 exp occlusive cerebrovascular disease/ 18 brain vasospasm/ 19 artery dissection/ 20 aneurysm rupture/ 21 brain injury/ 22 exp carotid artery/ 23 exp brain hemorrhage/ 24 stroke.mp. 25 cerebrovascular dis*.mp. 26 brain ischem*.mp. 27 brain hemorrhag*.mp. 28 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 29 exp Brazil/ 30 bra#il*.mp. 31 bra#il*.in. 32 bra#il*.cp. 33 29 or 30 or 31 or 32 34 7 and 28 and 33

Table 3 (continued)

Database	Search strategy
PsycINFO 1806–August 14th, 2017	1 exp dysphagia/ 2 exp swallowing/ 3 dysphag*.mp. 4 deglut*.mp. 5 swallow*.mp. 6 swalow*.mp. 7 aspirat*.mp. 8 1 or 2 or 3 or 4 or 5 or 6 or 7 9 exp Cerebrovascular Accidents/ 10 exp Cerebrovascular Disorders/ 11 exp Cerebral Ischemia/ 12 exp thromboses/ 13 exp aneurysms/ 14 exp Brain Damage/ 15 exp Carotid Arteries/ 16 exp Cerebral Hemorrhage/ 17 stroke.mp. 18 cerebrovascular dis*.mp. 19 brain ischem*.mp. 20 brain hemorrhag*.mp. 21 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 22 Brazil.mp. 23 bra#il*.mp. 24 bra#il*.in. 25 bra#il*.cp. 26 22 or 23 or 24 or 25 27 8 and 21 and 26
CINAHL 1978–August 14th, 2017	S1 (MH ”Deglutition Disorders” S2 TX dysphag* S3 (MH ”Deglutition”) S4 TX swallow* S5 (MH ”Aspiration”) S6 TX aspirat* S7 (MH ”Stroke+”) S8 (MH ”Cerebrovascular Disorders+”) S9 (MH ”Basal Ganglia Cerebrovascular Disease+”) S10 (MH ”Hypoxia-Ischemia, Brain+” S11 (MH ”Cerebral Ischemia+”) S12 (MH ”Hypoxia-Ischemia, Brain+”) S13 (MH ”Intracranial Hemorrhage”) S14 (MH ”Intracranial Arterial Diseases+”) S15 (MH ”Arteriovenous Malformations” S16 (MH ”Intracranial Embolism”) S17 (MH ”Intracranial Thrombosis+”) S18 (MH ”Cerebral Vasospasm”) S19 (MH ”Vertebral Artery Dissections”) S20 (MH ”Aneurysm”) S21 (MH ”Brain Injuries”) S22 (MH ”Carotid Arteries”) S23 TX stroke S24 TX cerebrovascular dis* S25 TX brain ischem* S26 TX brain hemorrhag* S27 TX ictus S28 TX CVA S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 S29 S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S30 (MH ”Brazil”) S31 TX Brazil* S32 TX Brasil* S33 S30 OR S31 OR S32 S34 S1 OR S2 OR S3 OR S4 OR S5 OR S6 S35 S29 AND S33 AND S34

Table 3 (continued)

Database	Search strategy
Cochrane Database of Systematic Reviews 1998–August 14th, 2017	#1 MeSH descriptor: [Deglutition Disorders] explode all trees #2 dysphag* #3 deglut* #4 swallow* #5 swalow* #6 aspirat* #7 #1 or #2 or #3 or #4 or #5 or #6 #8 MeSH descriptor: [Stroke] explode all trees #9 MeSH descriptor: [Cerebrovascular Disorders] explode all trees #10 MeSH descriptor: [Basal Ganglia Cerebrovascular Disease] explode all trees #11 MeSH descriptor: [Brain Ischemia] explode all trees #12 MeSH descriptor: [Brain Infarction] explode all trees #13 MeSH descriptor: [Hypoxia–Ischemia, Brain] explode all trees #14 MeSH descriptor: [Intracranial Arterial Diseases] explode all trees #15 MeSH descriptor: [Intracranial Arteriovenous Malformations] explode all trees #16 MeSH descriptor: [Intracranial Embolism] explode all trees #17 MeSH descriptor: [Intracranial Thrombosis] explode all trees #18 MeSH descriptor: [Vasospasm, Intracranial] explode all trees #19 MeSH descriptor: [Vertebral Artery Dissection] explode all trees #20 MeSH descriptor: [Aneurysm, Ruptured] explode all trees #21 MeSH descriptor: [Brain Injuries] explode all trees #22 MeSH descriptor: [Carotid Arteries] explode all trees #23 MeSH descriptor: [Intracranial Hemorrhages] explode all trees #24 stroke #25 cerebrovascular dis* #26 brain ischem* #27 brain hemorrhag* #28 #8 or #9 or #10 or #11 or #12 or #13 or #14 or #15 or #16 or #17 or #18 or #19 or #20 or #21 or #22 or #23 or #24 or #25 or #26 or #27 #29 #7 and #28 #30 MeSH descriptor: [Brazil] explode all trees #31 #29 and #30
Cochrane Central Register of Controlled Trials 1956–August 14th, 2017	#1 MeSH descriptor: [Deglutition Disorders] explode all trees #2 dysphag* #3 deglut* #4 swallow* #5 swalow* #6 aspirat* #7 #1 or #2 or #3 or #4 or #5 or #6 #8 MeSH descriptor: [Stroke] explode all trees #9 MeSH descriptor: [Cerebrovascular Disorders] explode all trees #10 MeSH descriptor: [Basal Ganglia Cerebrovascular Disease] explode all trees #11 MeSH descriptor: [Brain Ischemia] explode all trees #12 MeSH descriptor: [Brain Infarction] explode all trees #13 MeSH descriptor: [Hypoxia–Ischemia, Brain] explode all trees #14 MeSH descriptor: [Intracranial Arterial Diseases] explode all trees #15 MeSH descriptor: [Intracranial Arteriovenous Malformations] explode all trees #16 MeSH descriptor: [Intracranial Embolism] explode all trees #17 MeSH descriptor: [Intracranial Thrombosis] explode all trees #18 MeSH descriptor: [Vasospasm, Intracranial] explode all trees #19 MeSH descriptor: [Vertebral Artery Dissection] explode all trees #20 MeSH descriptor: [Aneurysm, Ruptured] explode all trees #21 MeSH descriptor: [Brain Injuries] explode all trees #22 MeSH descriptor: [Carotid Arteries] explode all trees #23 MeSH descriptor: [Intracranial Hemorrhages] explode all trees #24 stroke #25 cerebrovascular dis* #26 brain ischem* #27 brain hemorrhag* #28 #8 or #9 or #10 or #11 or #12 or #13 or #14 or #15 or #16 or #17 or #18 or #19 or #20 or #21 or #22 or #23 or #24 or #25 or #26 or #27 #29 #7 and #28 #30 MeSH descriptor: [Brazil] explode all trees #31 #29 and #30

Table 3 (continued)

Database	Search strategy
IBECS using "Subject descriptor" 2000–August 14th, 2017	Stroke or "Cerebrovascular Disorders" or "Basal Ganglia Cerebrovascular Disease" or "Brain Ischemia" or "Hypoxia–Ischemia, Brain" or "Brain Infarction" or "Intracranial Arterial Diseases" or "Intracranial Arteriovenous Malformations" or "Intracranial Embolism" or "Intracranial Thrombosis" or "Intracranial Hemorrhages" or "Vasospasm, Intracranial" or "Vertebral Artery Dissection" or "Aneurysm, Ruptured" or "Brain Injuries" or "Carotid Arteries" [Subject descriptor] and Deglutition or "Deglutition Disorders" or "Pneumonia, Aspiration" or "Respiratory Aspiration" [Subject descriptor]
IBECS using "words" 2000–August 14th, 2017	Stroke or (Cerebrovascular and Dis$) or (Basal and Ganglia and Cerebrovascular and Disease) or (Brain and Ischem$) or (Hypoxia–Ischemia and Brain) or (Brain and Infarction) or (Intracranial and Arterial and Diseases) or (Intracranial and Arteriovenous and Malformations) or (Intracranial and Embolism) or (Intracranial and Thrombosis) or (Intracranial and Hemorrhag$) or (Vasospasm and Intracranial) or (Vertebral and Artery and Dissection) or (Aneurysm and Ruptured) or (Brain and Injuries) or (Carotid and Arteries) or ictus or (Acidente and Vascular and Cerebral) or (Acidente and Vascular and Encefalico) or (Doença and cerebrovascular and ganglio and basal) or (Isquem$ and intracranial) or (Hemorrag$ and intracranial) or (hipoxia-isquem$ and cerebral) or (infarto and cerebral) or (doença and arterial and intracranial) or (malformação and cerebral and arteriovenosa) or (embolismo and intracranial) or (trombose and intracranial) or (vasoespasmo and intracranial) or (dissecção and arteria and vertebral) or (ruptura and aneurisma) or (dano and cerebral) or (arterias and carotidas) or AVC or AVE [Words] and dysphag$ or deglut$ or swallow$ or swalow$ or aspira$ or disfag$ [Words]
Lilacs using "Subject descriptor" 1983–August 14th, 2017	Stroke or "Cerebrovascular Disorders" or "Basal Ganglia Cerebrovascular Disease" or "Brain Ischemia" or "Hypoxia–Ischemia, Brain" or "Brain Infarction" or "Intracranial Arterial Diseases" or "Intracranial Arteriovenous Malformations" or "Intracranial Embolism" or "Intracranial Thrombosis" or "Intracranial Hemorrhages" or "Vasospasm, Intracranial" or "Vertebral Artery Dissection" or "Aneurysm, Ruptured" or "Brain Injuries" or "Carotid Arteries" [Subject descriptor] and Deglutition or "Deglutition Disorders" or "Pneumonia, Aspiration" or "Respiratory Aspiration" [Subject descriptor]
Lilacs using "words" 1983–August 14th, 2017	Stroke or (Cerebrovascular and Dis$) or (Basal and Ganglia and Cerebrovascular and Disease) or (Brain and Ischem$) or (Hypoxia–Ischemia and Brain) or (Brain and Infarction) or (Intracranial and Arterial and Diseases) or (Intracranial and Arteriovenous and Malformations) or (Intracranial and Embolism) or (Intracranial and Thrombosis) or (Intracranial and Hemorrhag$) or (Vasospasm and Intracranial) or (Vertebral and Artery and Dissection) or (Aneurysm and Ruptured) or (Brain and Injuries) or (Carotid and Arteries) or ictus or (Acidente and Vascular and Cerebral) or (Acidente and Vascular and Encefalico) or (Doença and cerebrovascular and ganglio and basal) or (Isquem$ and intracranial) or (Hemorrag$ and intracranial) or (hipoxia-isquem$ and cerebral) or (infarto and cerebral) or (doença and arterial and intracranial) or (malformação and cerebral and arteriovenosa) or (embolismo and intracranial) or (trombose and intracranial) or (vasoespasmo and intracranial) or (dissecção and arteria and vertebral) or (ruptura and aneurisma) or (dano and cerebral) or (arterias and carotidas) or AVC or AVE [Words] and dysphag$ or deglut$ or swallow$ or swalow$ or aspira$ or disfag$ [Words]
Scielo 1955–August 14th, 2017	(Stroke or (Cerebrovascular and Dis$) or (Basal and Ganglia and Cerebrovascular and Dis$) or (Brain and Ischem$) or (Hypoxia–Ischemia and Brain) or (Brain and Infarction) or (Intracranial and Arterial and Diseases) or (Intracranial and Arteriovenous and Malformations) or (Intracranial and Embolism) or (Intracranial and Thrombosis) or (Intracranial and Hemorrhag$) or (Vasospasm and Intracranial) or (Vertebral and Artery and Dissection) or (Aneurysm and Ruptured) or (Brain and Injuries) or (Carotid and Arteries) or ictus or (Acidente and Vascular and Cerebral) or (Acidente and Vascular and Encefalico) or (Doença and cerebrovascular and ganglio and basal) or (Isquem$ and intracranial) or (Hemorrag$ and intracranial) or (hipoxia-isquem$ and cerebral) or (infarto and cerebral) or (doença and arterial and intracranial) or (malformação and cerebral and arteriovenosa) or (embolismo and intracranial) or (trombose and intracranial) or (vasoespasmo and intracranial) or (dissecção and arteria and vertebral) or (ruptura and aneurisma) or (dano and cerebral) or (arterias and carotidas) or AVC or AVE) and (dysphag$ or deglut$ or swallow$ or swalow$ or aspira$ or disfag$)

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