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Swallowing disorders in older people with dementia due to Alzheimer's disease: videofluoroscopic findings

Transtornos de deglutição em pessoas idosas com demência por doença de Alzheimer: achados videofluoroscópicos

Patrícia Marques de Oliveira[1], *Laélia Cristina Caseiro Vicente*[2], *Grazielle Duarte de Oliveira*[3], *Maria Aparecida Camargos Bicalho*[4], *Amélia Augusta de Lima Friche*[2]

ABSTRACT

Purpose: To analyze the biomechanics of swallowing in older people with Alzheimer's disease who are fed orally, regarding the presence and severity of dysphagia and laryngotracheal aspiration, and to verify if there is an association with demographic characteristics and disease severity. **Methods:** This cross-sectional observational study analyzed videofluoroscopic swallowing studies of 55 older adults with Alzheimer's disease, without other associated neurological diseases, of both sexes, on exclusive oral feeding. The presence of dysphagia and laryngeal penetration and tracheal aspiration was assessed using the O'Neil and Rosenbek scales. Descriptive and association analyses were performed with a 5% significance level. **Results:** Most participants had functional swallowing (87.3%). When dysphagia was present, mild severity prevailed (9.1%). The frequency of laryngotracheal penetration/aspiration was 10.9%, with a higher occurrence of penetration of liquid consistency. There were alterations in all phases of swallowing, with the most frequent impairments related to chewing (100%), presence of oral residue (96%), pharyngeal residue (80%), and esophageal transit (82%). An association was found between dysphagia and the severity of dementia and age. **Conclusion:** Functional swallowing was frequent among the analyzed population. The presence of dysphagia in Alzheimer's disease was associated with more advanced dementia and older age. All phases of swallowing showed some impairment, indicating the importance of investigating swallowing, even in older adults on exclusive oral feeding.

Keywords: Alzheimer's disease; Deglutition; Deglutition disorders; Fluoroscopy; Dementia; Digestive system and oral physiological phenomena

RESUMO

Objetivo: analisar a biomecânica da deglutição de pessoas idosas com doença de Alzheimer que se alimentam por via oral, quanto à presença e gravidade da disfagia e aspiração laringotraqueal, e verificar se há associação com as características demográficas e gravidade da doença. **Métodos:** estudo observacional do tipo transversal, no qual foram analisados os exames de videofluoroscopia da deglutição de 55 pessoas idosas com doença de Alzheimer, sem outras doenças neurológicas associadas, de ambos os gêneros com via oral de alimentação exclusiva. As presenças de disfagia e de penetração/aspiração foram avaliadas pelas escalas de O'Neil e Rosenbeck. Foram realizadas análises descritivas e de associação com nível de significância de 5%. **Resultados:** a maioria dos participantes apresentou deglutição funcional (87,3%). Quando havia disfagia, prevaleceu a gravidade leve (9,1%). A frequência de penetração/aspiração laringotraqueal foi de 10,9%, com maior ocorrência de penetração para a consistência líquida. Houve alterações em todas as fases da deglutição, sendo os comprometimentos mais frequentes referentes à mastigação (100%), presença de resíduos oral (96%), faríngeo (80%) e trânsito esofágico (82%). Houve associação entre a presença de disfagia e a gravidade da demência e idade. **Conclusão:** a deglutição funcional foi frequente entre a população analisada. A presença de disfagia na doença de Alzheimer foi associada às demências mais avançadas e às pessoas mais velhas. Todas as fases da deglutição apresentaram algum comprometimento, indicando a importância da investigação da deglutição, mesmo em idosos com via oral de alimentação exclusiva.

Palavras-chave: Doença de Alzheimer; Deglutição; Transtornos de deglutição; Fluoroscopia; Demência; Fenômenos fisiológicos orais e do sistema digestório

Study carried out in the Postgraduate Program in Speech-Language-Hearing Sciences, Federal University of Minas Gerais – UFMG – Belo Horizonte (MG), Brazil.
[1]Programa de Pós-graduação em Ciências Fonoaudiológicas, Universidade Federal de Minas Gerais – UFMG – Belo Horizonte (MG), Brasil.
[2]Departamento de Fonoaudiologia, Faculdade de Medicina, Universidade Federal de Minas Gerais – UFMG – Belo Horizonte (MG), Brasil.
[3]Programa de Pós-graduação em Ciências Aplicadas à Saúde do Adulto, Universidade Federal de Minas Gerais – UFMG – Belo Horizonte (MG), Brasil.
[4]Departamento de Medicina, Faculdade de Medicina, Universidade Federal de Minas Gerais – UFMG – Belo Horizonte (MG), Brasil.
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Corresponding author: Patrícia Marques de Oliveira. E-mail: patissamo@hotmail.com
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INTRODUCTION

Alzheimer's disease (AD) is responsible for approximately 60%-80% of all cases of dementia in older people and is one of the main causes of morbidity and mortality in this population[1]. The prevalence rate of dementia in the Brazilian older population is considered to be 12.7 %[2], with AD accounting for 55% of cases[3].

One of the most frequent symptoms in patients with neurodegenerative diseases, such as AD, is dysphagia or a swallowing disorder[4,5]. Its prevalence is especially high in AD, mainly in the moderate and severe stages of the disease, reaching between 83% and 94% of individuals[6]. However, research indicates that swallowing alterations can appear in the early stages of AD, being characterized as a recurrent functional impairment in these patients[7].

Studies report that dysphagia in AD is associated with functional changes in the cortical network and dysfunctions in the autonomic nervous system, which mainly affect the oral and pharyngeal phases of swallowing[4,7]. In addition, neurocognitive factors (e.g., visual, tactile, and oral agnosia) and swallowing apraxia contribute to these alterations[8,9]. Cognitive decline can also modify patients' eating habits, increasing their dependence, even before the onset of dysphagia symptoms[9,10]. The decrease in ingestion speed and volume, directly linked to apraxia and sensorimotor deficits, stands out among the main impacts[11].

The most frequent signs and symptoms of dysphagia in the early stages of AD are impaired chewing, coughing or choking when consuming solid or liquid foods, need for verbal cues to initiate swallowing, and oral residue[7]. In moderate stages, there is passivity, distractibility, food refusal[9], and involvement of the pharyngeal phase, whose alterations can lead to aspiration during or after food intake[7]. In advanced stages, there is also decreased nutritional status, lack of appetite, habit of storing food in the mouth[12], difficulty initiating meals, passivity, refusal to eat[8], and swallowing apraxia[11].

Given this progressive clinical picture, the videofluoroscopic swallowing study (VFSS) is consolidated as the essential gold standard method for instrumental assessment, since it provides real-time qualitative and quantitative analysis of all phases of swallowing and the transitions between them[13]. Hence, this study chose to use this method.

Evidence obtained through VFSS in patients with AD reveals increased oral transit time (particularly in advanced dementia)[8,14], delayed or uncoordinated swallowing, difficulties in bolus formation and propulsion, accumulation of residues in the oropharyngeal region, impaired opening of the pharyngoesophageal segment, and bolus penetration and aspiration[7,15].

Thus, dysphagia in AD has negative consequences such as social isolation, malnutrition, dehydration, and aspiration pneumonia, which can lead to death[8]. Therefore, it is necessary to understand the swallowing alterations in AD and how they relate to demographic and clinical characteristics to develop interventions to address the problem, including in the initial phase of the disease, which can potentially maintain swallowing function as the disease progresses.

This study aimed to analyze the biomechanics of swallowing in older people with AD who feed orally, regarding the presence and severity of dysphagia and laryngotracheal aspiration, and to verify if there is an association with demographic characteristics and disease severity.

METHODS

This is a cross-sectional observational study with a non-probabilistic convenience sample, whose data were collected through analysis of VFSS imaging exams of older participants with dementia due to AD, assisted in the geriatrics service of the Clinics Hospital of the Federal University of Minas Gerais/EBSERH/HC/UFMG.

The study was approved by the institution's Research Ethics Committee (approval no. 4.458519). All participants were duly instructed and signed an informed consent form.

The study included VFSS images from 55 older adults aged 60 years or older with AD-related dementia, of both sexes, exclusively fed orally, with or without dysphagia, alert, able to remain seated during the instrumental assessment, without other associated neurological diseases, and who had not undergone speech-language-hearing therapy during or before the VFSS. Older adults who did not cooperate with the image acquisition procedures and those with a history or neuroimaging of stroke were excluded.

All participants were diagnosed with dementia due to AD, according to the consensus reached by the Scientific Department of Cognitive Neurology and Aging of the Brazilian Academy of Neurology on the diagnostic criteria for AD in Brazil[16]. They were classified using the Clinical Dementia Rating (CDR) scale[16] by a duly trained geriatrician from the HC/UFMG elderly healthcare referral center. The CDR classifies dementia as mild (CDR 1), moderate (CDR 2), and severe (CDR 3)[16]. It is important to mention that this study did not control for factors such as medication use, history of respiratory infection, or dental condition.

The VFSS was performed by a speech-language-hearing pathologist and a radiology technician, using a Philips® Pulsera surgical C-arm. Images were captured at 30 frames per second, recorded on an imaging system of the fluoroscopy equipment, and stored on a DVD-RW disc for later analysis of the exams.

During the VFSS, the individuals remained seated, and the images were captured in lateral and anteroposterior positions; their upper and lower limits were the oral cavity and the stomach.

For the procedure, participants were asked to ingest standardized amounts of grape juice (or another flavor of their choice) for liquid consistency (IDDSI 1) (International Dysphagia Diet Standardization Initiative)[17], in volumes of 5 ml and 10 ml, offered in a syringe, and 20 ml for habitual swallowing, offered in a cup; extremely thick (IDDSI 4), in a volume of 8 ml, offered in a teaspoon; and 3-cm wafers for solid consistency (IDDSI 7). The portions were offered three times for each consistency in the lateral position and three times for each consistency in the anteroposterior position. All foods were supplemented with Bariogel® contrast (BARIOGEL – Cristália Produtos Químicos e Farmacêuticos LTDA., Brazil) at a 100% concentration – 1 g/ml. A 1:1 ratio was used for IDDSI 1 (50% juice and 50% barium); the same proportion of liquid was used for IDDSI 4, adding thickener until an extremely thick consistency was achieved, prepared according to the manufacturer's recommendation for the food thickener used (Thick Easy®). The wafer pieces were soaked in barium only when they were served to maintain consistency.

After the examination, all older adults underwent a speech-language-hearing clinical evaluation. Their caregivers were instructed regarding the adequacy of food consistency, utensils

used, posture while eating, and environmental distractors, aiming at safe swallowing.

A speech-language-hearing pathologist and a geriatrician with experience in VFSS analyzed the structures with visual-perceptual biomechanical parameters[18,19] of the oral preparatory, oral, pharyngeal, and esophageal phases of swallowing, based on the service protocol. They evaluated alterations in the oral preparatory phase regarding intake, lip closure, oral motor control, chewing, bolus concentration, and penetration and/or aspiration before swallowing. In the oral phase, they evaluated alterations in tongue-palate contact, oral bolus propulsion, anterior spillage, posterior spillage, penetration, and/or aspiration before swallowing, and oral residue. In the pharyngeal phase, they evaluated alterations in velopharyngeal closure, tongue base movement, swallowing initiation site[19], hyolaryngeal elevation, laryngeal inlet closure, pharyngeal constrictor constriction, pharyngeal bolus propulsion, bolus transition through the pharyngoesophageal segment, penetration and/or aspiration during and/or after swallowing, and pharyngeal residue[20].

In the esophageal phase, they evaluated alterations in esophageal transit and tertiary contractions, which are non-propulsive, disorganized movements frequently associated with esophageal dysmotility[21].

A speech-language-hearing pathologist who did not participate in the analysis coded the examinations of participants with AD. Thus, professionals trained in interpreting VFSS images and with more than 15 years of experience working with dysphagia patients analyzed the biomechanical swallowing analyses without identifying the participants. The images were analyzed in real time, frame by frame, and frozen as many times as necessary. For intrarater agreement analysis, 20% of the sample, with a different code from the first presentation, was re-presented for blind evaluation. The Kappa test showed 74.4% agreement for the dysphagia severity scale[22] and 100% for the laryngotracheal penetration/aspiration scale[23].

The severity of dysphagia was classified with the Dysphagia Outcome and Severity Scale (DOSS)[22], as follows: level 7 – normal swallowing; level 6 – within functional limits/spontaneous compensations; level 5 – mild dysphagia; level 4 – mild/moderate dysphagia; level 3 – moderate dysphagia; level 2 – moderate/severe dysphagia; level 1 – severe dysphagia[23].

The Penetration-Aspiration Scale (PAS)[23] was used to classify laryngotracheal penetration/aspiration. It assesses how far the bolus enters the lower airway and how the patient reacts, being classified as level 1 (contrast does not enter the airway); level 2 (contrast enters up to above the vocal folds [VFs], no residue); level 3 (contrast remains above the VFs, visible residue); level 4 (contrast reaches VFs, no residue); level 5 (contrast reaches VFs, visible residue); level 6 (contrast surpasses the VFs, but there is no residue at the subglottic level); level 7 (contrast surpasses the VFs with residue at the subglottic level, although the patient responds); and level 8 (contrast surpasses the VFs with residue in the subglottis, but the patient does not respond).

The response variables of the study were the presence of dysphagia (DOSS) and laryngotracheal penetration/aspiration (PAS). The explanatory variables were age, sex, and CDR.

Descriptive analyses of the data were performed using absolute and relative frequency distribution for categorical variables and numerical synthesis for continuous variables.

The analysis of qualitative variables related the events of each phase of swallowing (oral preparatory, oral, pharyngeal, and esophageal) to the consistencies offered (5 ml and 10 ml liquid, extremely thick, and solid).

The response variables DOSS and PAS were stratified into two categories for association analysis: absence and presence of dysphagia and laryngotracheal penetration/aspiration, respectively. Dysphagia was considered present when the classification ranged between levels 1 and 5 and absent between levels 6 and 7. Penetration or aspiration was considered present when the classification ranged between levels 2 and 8.

The explanatory variable CDR was also stratified into two categories: mild and moderate/severe dementia.

The continuous variable age was assessed for distribution using the Kolmogorov-Smirnov test and showed a normal distribution ($p = 0.186$). Fisher's exact test was used for the analysis of the association between response and explanatory variables. All analyses used a 5% significance level and a 95% confidence interval. The database was structured in Excel and analyzed using the SPSS statistical program, version 20.

RESULTS

Of the 55 exams analyzed, 37.5% were from male participants and 62.5% from female participants. The mean age was 81 years and 9 months with a standard deviation (SD) of 7 years and 7 months. The severity of dementia was similarly distributed across the CDR scale levels: mild (33%), moderate (35.1%), and severe (31.4%). The mean age of participants with mild CDR was 79 years and 2 months (SD = 8 years and 3 months), and that of participants with moderate and severe CDR was 84 years and 5 months (SD = 5 years and 8 months).

The analysis, according to the DOSS, showed that no older person had normal swallowing, but most participants were classified as having functional swallowing (87.3%). When dysphagia was present, the mild degree (level 5) prevailed. PAS results revealed the presence of penetration/aspiration in a few participants (10.9%), with a higher occurrence of levels related to penetration (Table 1).

Biomechanical alterations were observed in all phases of swallowing in older adults with AD. In the oral preparatory phase of swallowing, chewing was altered in all participants, with the majority characterized as inefficient (72.2%), slowed (61.1%), and unilateral (55.6%). The other symptoms showed a low frequency of alterations, such as bolus concentration for IDDSI 1 and oral motor control for IDDSI 1 and 7 (Table 2).

In the oral phase of swallowing, oral residue (96%) and alteration in bolus propulsion were observed with all consistencies, being more frequent for IDDSI 7 (80.8%) (Table 2). Regarding alterations in food bolus propulsion, the most frequent impairment was food fragmentation with IDDSI 7 (57.7%), followed by delayed propulsion onset with IDDSI 7 (44.2%), inefficient ejection with IDDSI 7 (32.9%), and uncoordinated movements with IDDSI 1 in both volumes evaluated (around 25%).

In the pharyngeal phase, residue was found in the region in all consistencies in more than 80% of participants, except with IDDSI 4 (60.8%). A delayed onset of the pharyngeal phase of swallowing was observed more frequently with IDDSI 7 (70%). The other events of the pharyngeal phase also showed alterations, although less frequently. Low occurrence of penetration during swallowing was observed with all consistencies, being more frequent with 5-ml IDDSI 1 (5.5%), as well as low occurrence of penetration or aspiration after

Table 1. Description of the classifications of dysphagia severity scales and penetration and aspiration scales of participants with Alzheimer's disease

Penetration and Aspiration Scale (PAS)		
	N	%
Level 1	49	89.1
Level 2	1	1.8
Level 3	1	1.8
Level 4	0	0.0
Level 5	1	1.8
Level 6	1	1.8
Level 7	2	3.6
Total	55	100.0
Penetration and Aspiration Scale (PAS) in two categories		
	N	%
Absent (level 1)	49	89.1
Present (levels ≥ 2)	6	10.9
Total	55	100.0
Dysphagia Outcome and Severity Scale (DOSS)		
	N	%
Level 1 – Severe dysphagia	0	0.0
Level 2 - Moderate/severe dysphagia	1	1.8
Level 3 – Moderate dysphagia	0	0.0
Level 4 - Mild/moderate dysphagia	1	1.8
Level 5 - Mild dysphagia	5	9.1
Level 6 - Functional Swallowing	48	87.3
Level 7 – Normal swallowing	0	0.0
Total	55	100.0
Dysphagia Outcome and Severity Scale (DOSS) in two categories		
		%
Absent (Levels 7 and 6)		87.3
Present (Levels 5 to 1)		12.7
Total		100.0

Caption: N = number of participants; % = percentage; DOSS = Dysphagia Outcome and Severity Scale; PAS = The Penetration-Aspiration Scale

swallowing all consistencies; penetration was more frequent with 10-ml IDDSI 1 (7.3%) (Table 2).

In the esophageal phase, an alteration in esophageal transit was observed with all consistencies in most participants (Table 2), occurring more slowly.

Regarding dysphagia, the bivariate analysis identified associations with the severity of dementia when categorized into two groups (with and without dysphagia), and all older people who presented with dysphagia had moderate or severe dementia. Sex was not associated with dysphagia, and penetration or aspiration was not associated with sex or the severity of dementia (Table 3).

The comparison of age between the penetration/aspiration and dysphagia scales showed higher mean ages for the presence of penetration/aspiration and dysphagia. However, it was only significant for the latter scale ($p = 0.032$) (Table 4).

DISCUSSION

This study analyzed the swallowing of older people with AD who were on exclusive oral feeding. It found that most participants had functional swallowing, although none had normal swallowing. Penetration/aspiration occurred in part of the sample (10.9%). Biomechanical impairments were observed in all phases of swallowing, and an association was found between dysphagia, moderate/severe dementia, and advanced age.

In the oral preparatory phase of swallowing, chewing was altered in all participants, being inefficient in most of them. Studies have identified that older people with AD have greater masticatory impairment than healthy ones. Older adults become more prone to muscle fatigue due to hypotonia of the masticatory muscle fibers, absence of teeth, periodontal problems, use of dental prostheses, and reduced saliva production[24]. Moreover, sensory alterations, such as taste and smell, and decreased salivary production impair the organization of the food bolus, also resulting in difficulty chewing[25]. Therefore, alterations in chewing are multifactorial, resulting from agnosia, apraxia, and aging. It is worth noting that this study did not investigate dentition, denture use, saliva production, or muscle tone.

The high proportion of oral residue in the oral phase (96%) with all consistencies stands out in the present study, in addition to alterations in bolus propulsion, mainly with solids. Changes in the oral cavity, whether due to aging or some alteration in the dynamics of this phase, can reduce tongue mobility and its movement strength[7,8,26], which would justify these findings. Prolonged oral transit of pudding-thick food in older adults with AD is frequently associated with alterations in executive function and oral-tactile agnosia[14].

The pharyngeal phase showed alterations with a delayed onset with IDDSI 7, residue of all consistencies except IDDSI

Table 2. Description of biomechanical changes in swallowing in participants with Alzheimer's disease

Oral preparatory phase		IDDS 1 5 ml (%)	IDDS 1 10 ml (%)	IDDSI 4 (%)	IDDSI 7 (%)
Mastication	Adequate	-	-	-	-
	Abnormal	-	-	-	100
Motor control	Adequate	74.5	73.1	86.3	79.5
	Abnormal	25.5	26.9	13.7	20.5
Bolus concentration	Adequate	67.3	61.8	83.3	71.7
	Abnormal	32.7	38.2	16.7	28.3
Penetration before	Absent	98.2	100.0	100.0	100.0
	Present	1.8	-	-	-
Aspiration before	Absent	100.0	100.0	100.0	100.0
	Present	-	-	-	-
Oral phase					
Oral propulsion of the bolus	Adequate	50.9	49.1	54.5	19.2
	Abnormal	49.1	50.9	45.5	80.8
Penetration before	Absent	100.0	100.0	100.0	100.0
	Present	-	-	-	-
Aspiration before	Absent	100.0	100.0	100.0	100.0
	Present	-	-	-	-
Oral residue	Absent	3.6	3.6	5.6	4.4
	Present	96.4	96.4	94.4	95.6
Pharyngeal phase					
Velopharyngeal closure	Adequate	78.0	80.0	83.6	74.5
	Abnormal	22.0	20.0	16.4	25.5
Onset of the pharyngeal phase	Adequate	66.7	67.3	61.5	30.0
	Abnormal	33.3	32.7	38.5	70.0
Pharyngeal propulsion of the bolus	Adequate	68.6	68.6	69.8	48.0
	Abnormal	31.4	31.4	30.2	52.0
Transition of the pharyngoesophageal segment	Adequate	64.7	64.7	64.7	57.8
	Abnormal	35.3	35.3	35.3	42.2
Penetration during	Absent	94.5	96.4	98.2	98.2
	Present	5.5	3.6	1.8	1.8
Aspiration during	Absent	100.0	98.2	100.0	100.0
	Present	-	1.8	-	-
Pharyngeal residue	Absent	16.3	15.7	39.2	18.2
	Present	83.7	84.3	60.8	81.8
Esophageal phase					
Penetration after	Absent	96.4	92.7	96.4	98.2
	Present	3.6	7.3	3.6	1.8
Aspiration after	Absent	98.2	98.2	98.2	98.2
	Present	1.8	1.8	1.8	1.8
Esophageal transit	Adequate	18.0	17.0	20.4	13.3
	Abnormal	82.0	83.0	79.6	86.7

Caption: IDDSI = International Dysphagia Diet Standardization Initiative; IDDSI 1 = slightly thick liquid; IDDSI 4 = extremely thick liquid; IDDSI 7 = solid; ml = milliliters; % = percentage

4, and penetration during swallowing of all consistencies, with low occurrence, being more frequent with 5-ml IDDSI 1. Studies also identified safe swallowing in most patients with dementia[15,27]. However, the occurrence of residue in valleculae and pyriform sinuses was the most common sign, with the relative risk of unsafe swallowing being three times higher in the presence of IDSSI 1 residue in pyriform sinuses[15]. Moreover, liquids with more adherent viscosities can cause aspirations due to the increased risk of post-swallowing residue in the pharynx[4]. This is an important warning for professionals working with this population in meal management.

Lower airway protection in AD can be affected by factors such as decreased hyolaryngeal elevation, delayed closure of the laryngeal vestibule, decreased opening of the pharyngoesophageal segment, reduced tone of pharyngeal constrictors[8] due to aging, and changes caused by cognitive decline[25]. Therefore, as pharyngeal residues were frequent in the study population, future studies must investigate the relationship with the risk of penetration/aspiration.

The present study found slow esophageal transit of all consistencies evaluated, which may be attributed to the participants' mean age (82 years). Changes in the stiffness, circumference, and length of the esophageal wall are related to presbyphagia[26].

Table 3. Bivariate analysis of the results between the penetration and aspiration scales and the dysphagia severity scale, and the sociodemographic and clinical variables

Variables	Penetration/Aspiration (PAS)					Dysphagia (DOSS)				
	Absent		Present		p-value	Absent		Present		p-value
	N	%	N	%		N	%	N	%	
Sex										
Males	17	40.5	1	16.7	0.257*	16	38.6	2	28.6	0.469*
Females	25	59.5	5	83.5		25	61.4	5	71.4	
Total	42	100.0	6	100.0		41	100.0	7	100.0	
CDR										
1 – Mild dementia	18	37.5	0	0.0	0.097**	18	38.3	0	0.0	0.119**
2 – Moderate dementia	16	33.3	3	50.0		15	31.9	4	57.1	
3 – Severe dementia	14	29.2	3	50.0		14	29.8	3	42.9	
Total	48	100.0	6	100.0		47	100.0	7	100.0	
CDR (2 categories)										
1 – Mild dementia	18	37.5	0	0.0	0.075*	18	38.3	0	0.0	0.047*
2, 3 – Moderate/severe dementia	30	62.5	6	100.0		29	61.7	7	100.0	
Total	48	100.0	6	100.0		47	100.0	7	100.0	

*Fisher's exact test **Linear association

Caption: N = number of participants; % = percentage; DOSS = Dysphagia Outcome and Severity Scale; PAS = Penetration-Aspiration Scale CDR = Clinical Dementia Rating

Note: The number of responses varied due to missing data

Table 4. Comparison of mean ages and the Dysphagia Outcome and Severity Scale and Penetration-Aspiration Scale

Scales	Penetration/aspiration (PAS)		Dysphagia severity (DOSS)	
Age	Present	Absent	Present	Absent
Median	86.50	82.00	87.00	82.00
Mean	86.83	81.37	87.71	81.25
Standard deviation	7.20	7.69	6.97	7.44
p-value*	0.104		0.032	

*T-test

Caption: DOSS = Dysphagia Outcome and Severity Scale; PAS = Penetration-Aspiration Scale

There is a fine line between presbyphagia and dysphagia in AD, especially in the early stages of the disease, as many changes in biomechanics can be attributed to natural aging. Sensorimotor changes, post-swallow residue, less oral moisture, and reduced acuity of taste and smell can worsen swallowing in older people[26,28].

However, it is believed that when the severity of dementia is associated with dysphagia, the relationship with AD is pressing, since all older adults with dysphagia had moderate or severe AD. As mentioned, the literature indicates a reciprocal relationship between cognitive impairment, performance disorders, and swallowing in dementia, in which worse results in tests of memory, language, praxis, orientation, attention, and executive functions are associated with changes in swallowing[25].

The study findings and the literature[7,9,15,28,29] reinforce that both the physiological changes of aging and cognitive decline compromise the biomechanics of swallowing in AD. Caregivers may eventually underestimate the signs and symptoms of dysphagia. The high cost of VFSS and difficult access to it often make it impossible to perform it routinely in services that provide care to older people with AD. Although speech-language-hearing clinical evaluation is essential for this population[7], it is important to recognize its limitations, such as the difficulty in identifying pharyngeal residue and silent penetrations and aspirations.

Some limitations of this study should be pointed out, such as the lack of information in the medical records regarding the age of onset and duration of the disease; the absence of data on the participants' dental conditions; the exclusion of non-cooperative patients, since the data collection procedures using the VFSS examination require minimal cooperation; the influence of distracting elements and fluctuations in attention; the use of utensils (e.g., syringes), which may have influenced swallowing performance and results during the examination.

On the other hand, the use of VFSS in a sample of older people treated at a referral service in a large urban center stands out, as does the adoption of a standardized protocol and the continuous monitoring by the speech-language-hearing pathologist during the examination. These factors allowed for proper management and correction of any interfering factors. Furthermore, radiation exposure was minimized, with all examinations performed in the shortest possible time, as recommended by safety standards.

Although most participants in this study were classified as having functional swallowing, all presented some impairment in the phases of swallowing. Thus, the findings suggest that both caregivers and health professionals should be attentive to the first signs and symptoms of dysphagia in people with AD, even in the early stages of the disease,

which is crucial in those with older age and more advanced cognitive impairment. Early diagnosis enables interventions to minimize impairments in the biomechanics of swallowing and, consequently, complications such as malnutrition, dehydration, and pulmonary aspiration.

CONCLUSION

Most older people with AD who were fed orally had their swallowing classified as functional using the DOSS. The presence of dysphagia was associated with advanced stages of AD and older ages.

The frequency of laryngotracheal penetration/aspiration was 10.9%, with penetration being more frequent, mainly with liquids, during and after swallowing. However, sex, age, and severity of dementia were not associated with laryngotracheal aspiration.

The characteristics of the most frequent swallowing disorders were altered chewing, oral and pharyngeal residues, and altered esophageal transit.

The results of this study indicated that older people with AD should have their swallowing biomechanics investigated to ensure efficient and safe functionality at all levels of disease severity, prioritizing the oldest and those in advanced stages of the disease.

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