

Prevalence of Swallowing Disorders and Its Association with Geriatric Syndromes in Elderly Patients Attending to a First Level Care Center

Díaz-Ramos Julio Alberto^{a, b, c}, Mondragón-Cervantes Martha Ivón^b, Jiménez-Acosta Yenesys del Carmen^b, Fraga-Ávila Claudia^b, Díaz-García Irma Fabiola^d, Coss-Adame Enrique^e, Leal-Mora David^{a, b}

^aUnidad de Atención Geriátrica de Alta Especialidad, Hospital Civil Fray Antonio Alcalde, Guadalajara, Jalisco, México.

^bTecnológico de Monterrey, Escuela de Medicina y Ciencias de la Salud, Campus Guadalajara, Jalisco, México

^cHospital General de Occidente, Guadalajara, Jalisco, México.

^dDepartamento de Clínicas Odontológicas Integrales, Universidad de Guadalajara, Jalisco, México

^eDepartamento de Gastroenterología, Laboratorio de Motilidad Gastrointestinal, Instituto Nacional de Ciencias Médicas y de la Nutrición Salvador Zubirán

Abstract: ***Background:** Worldwide ageing population is increasing and this is followed by an increase in some negative outcomes called Geriatric Syndromes (GS). A key element of overall health in elderly is adequate swallowing. The swallowing disorders (SD) have been associated with some GS, like malnutrition and depression in elders. **Objectives:** To determine the prevalence of Swallowing disorders (SD) and its associations between socio-demographic characteristics, health status and some GS in adults aged 60 or older, attending at first level care in Mexico. **Methods:** Cross-sectional study in participants aged ≥ 60 , recruited in 2016. Participants underwent a comprehensive geriatric assessment (CGA), with which the diagnosis of Swallowing disorders (SD) and GS was obtained. Regression analyses adjusted for confounding variables were determined to establish the association between the socio-demographic characteristics, Swallowing disorders (SD) and some GS. **Results:** We included 264 subjects; mean age was 73 years ($SD = \pm 6$), women accounted for 60%. Overall, 13% had cough when eating food and 12% had a choking feeling during swallowing. After adjusted by age, sex and literacy, multiple logistic regression analyses showed a significant association between cough, choking and some GS (falls, depression, pain, immobility and malnutrition risk). **Conclusions:** This study showed that the prevalence of swallowing disorders is higher in Mexican elders. These results suggest the importance of monitoring swallowing capabilities, as they seem to confer a negative impact on health status of the elderly, and that the swallowing evaluation should be included in the geriatric assessment to prevent GS.*

Keyword: Geriatric Syndrome; swallowing; dysphagia

1. Introduction

The worldwide ageing population is increasing, and it is predicted that by 2050 one in five people will be aged 60 years or more in developing countries^{1,2}. This demographic evolution may be associated with an increase in the prevalence of Geriatric Syndromes (GS)³⁻⁵. This term has commonly been used to indicate the “accumulated effect of impairments in multiple domains” that result in a particular adverse outcome in older people⁶. Falls, depression, disability, cognitive impairment, immobility, malnutrition and chronic pain are some of the more prevalent GS. Oropharyngeal dysphagia (OD) matches the definition of a geriatric syndrome as it is highly prevalent among older people, is caused by multiple factors, is associated with several comorbidities and poor prognosis, and needs a multidimensional approach to be treated⁷.

It is generally accepted that a key element of overall health is swallowing function^{8,9}. Any disruption in the swallowing process may be defined as dysphagia¹⁰. The risk for dysphagia or difficulty swallowing increases with age¹¹. In the US, dysphagia affects 300,000–600,000 people’s yearly¹². OD is pandemic among older people, affecting between 27% and 91% of the population 70 years or older¹³. The term presbyphagia refers to all changes of swallowing

physiology that are manifested with increasing age¹⁴. So, healthy aging takes its toll on head and neck anatomy and physiologic and neural mechanisms underpinning swallowing function. This progression of change contributes to alterations in the swallowing in healthy older adults, diminishing functional reserve^{8,9}. Loss of swallowing function can have negative outcomes including dehydration, pneumonia, as well as some GS (malnutrition, reduced quality of life in elders for example)¹⁵. Age-related changes place older adults at risk for dysphagia, and dysphagia is a co-morbidity of many age-related diseases and/or their treatments¹¹. Some of the more common symptoms, such as cough and choking, are often related to oral and pharyngeal disease¹⁶⁻²¹. World Health Organization defined OD as the difficulty or inability to move a bolus safely and effectively from the oral cavity to the esophagus, and can include aspirations, choking, and residue¹³. Despite its prevalence and severity, OD is still under diagnosed and untreated in many medical centers⁷.

This study aims to determine the prevalence of swallowing disorders and its associations between geriatric syndromes in adults aged 60 or older, attending at medical consultation of a first level unit of care in Mexico.

2. Material and Methods

Study population

Cross-sectional study including participants aged 60 or older, which were consecutively recruited from a primary care clinic (a family medicine unit N° 54 belonging to the Mexican Institute of Social Security of Mexico which grants 1700 consultations per year to adults ≥ 60 years) between September 2015 and April 2016. Subjects were invited to voluntarily participate in the study the day of their scheduled medical visit. Once participants agreed, they underwent a comprehensive geriatric assessment by trained staff using standardized methods. Detailed sociodemographic, swallowing disorders and GS information was also obtained. Subject who did not complete the questionnaire responses or did not authorize the consent were excluded to avoid the inclusion of incomplete covariates. The hospital Ethic Committee reviewed and approved the study protocol.

Assessments

Dependent variables

Depression, immobility risk, malnutrition and chronic pain were investigated as geriatric's syndromes outcome:

Depression

Depressive symptoms were assessed using the validated version of the 15-item Geriatric Depression Scale (GDS). A cut-off point of >5 indicated the presence of depression²².

Immobility risk

The Rosow-Breslau Functional Health Scale assessed mobility through 3 items (walking half a mile, climbing stairs, and doing heavy work around the house) in order to make high risk of immobility diagnosis²³.

Malnutrition

The nutritional risk was evaluated through the Questionnaire for the detection of malnutrition in older adults (DNA). The cut-off point of >6 indicated the presence of high nutritional risk, and <2 points was considered for low nutritional risk²⁴.

Chronic Pain

The presence of pain was assessed through the question: do you have pain? CGA and physical examination corroborated the presence and impact of pain.

Swallowing Disorders

Two swallowing disorders were investigated as independent variables: sensation of choking on eating foods and the presence of cough after eating. Participants who responded positively to the question "Do you sometimes choke on drinks/food such as tea and soup?" or those who presented with cough or abnormal repetitive saliva swallowing test findings were diagnosed with OD.

Covariates

Socio-demographic variables included age, sex, schooling, marital status, and morbidity variables. Education was recorded in years. Body mass index was calculated as measured weight in kilograms divided by measured height

in meters squared (kg/m^2). Individuals were considered as normal from 22 to 24; as overweighted 25 to 29; obese with >30 , and malnutrition <22 ²⁵.

Smoking status was categorized as current or not. A trained physician determined diseases according to standardized, well-known, pre-established criteria and algorithms combining information from self-reported diagnoses, medical records, current pharmacological treatment and clinical examinations. All participants were asked whether they had a diagnosis of any chronic diseases per the World Health Organization's International Classification of Diseases (ICD-10). Acutoff point of >2 were considered for polypharmacy²⁶⁻²⁷.

The falls was evaluated through a simple question: have you fallen on one occasion during the last year?²⁸. Impairment in basic (ADL) and instrumental activities of daily living (IADL) was used to identify disability^{29,30}. For each domain, if the participants indicated that they were unable to carry out at least one of the activities without assistance, they were considered as having disability. Cognitive function was assessed by the Mexican population validated version of the Mini-Mental State Examination (MMSE). The lower score was determined with a cut-off score of <23 , adjusted by age and education³¹.

Statistical Analyses

Baseline descriptive data for the final sample are shown as means and standard deviations for continuous variables and frequencies for categorical variables. χ^2 test or Fisher's exact test were used as appropriate. Logistic regression and Odds Ratios were used to determine the association strength between dependents (cough and choking) and independents (depression, immobility, malnutrition, and chronic pain) variables.

Univariate analyses were first performed to screen for predictor variables for GS. The choice of independent variables used in the univariate analyses was based on the review of literature and clinical judgment. In the next step, variables that were statistically significant at $P < 0.05$ levels in the univariate analyses were included in multivariate regression models with additional adjustment for age, sex, schooling and comorbidity. All analyses were evaluated using 95% confidence intervals and a P -value of <0.05 was considered statistically significant. Statistical analyses were performed in SPSS software for Windows® (SPSS Inc., Chicago, IL, version 19).

3. Results

The final sample was made up of 264 individuals aged 60 years or older; women accounted for 60%, and the mean of age was 73 ($SD = \pm 6$). The main baseline characteristics are presented in Table 1 between those and the presence of choking, and cough.

Of the total, 64% of the sample was married, and 28% were widowed. Regarding the education level, only 5% were illiterate. Almost 78% and 55% reported economic and health situation as good, respectively. The prevalence of

smoking was 36%. Hypertension and diabetes were the most prevalent morbidities (44% and 33%). The prevalence of polypharmacy was 84%, and the mean of prescribed drugs was 4.5 (SD \pm 2). The 47% of women and 11% of men presented one or more disabilities in the ADL scale respectively, and disability for IADL was 3%. A total of 47% had mild cognitive impairment, MMSE mean was 24 (SD \pm 4), and 25% had clinically depressive symptoms, with GDS score mean of 4 (SD \pm 3).

As for the nutritional status, 2% was on high nutritional risk and 83% in low nutritional risk. The mean in the DNA was 1 (SD \pm 1.5). According to the BMI, 22% were classified as overweight and up to 29.5% in obesity. The prevalence of weight loss in the last year was 15%. The mean weight in kg was 69 (SD \pm 12), and the BMI mean was 27 (SD \pm 5). 52% reported dental prosthesis use, and 33% reported the presence of dry mouth (xerostomia).

Seven per cent classified at high risk of immobility according to the Rosow-Breslau Functional Health Scale. The prevalence of at least one falls in the last year was 39%, and 15% used a gait auxiliary. The prevalence of old fractures was 26%. Up to 48% of the sample reported chronic pain.

Swallowing disorders variables were as follows: 13% had cough when eating food and 12% had had a choking feeling in swallowing.

Univariate and multivariate analysis

The results from the univariate regression analyses of the associations between baseline swallowing disorders variables and some GS are presented in Table 2. The unadjusted logistic regression analysis showed a significant association between cough and depression, cognitive impairment, immobility risk, weight loss, malnutrition risk, and chronic pain. Also a significant association was observed between choking and depression, immobility risk, weight loss, malnutrition risk. Factors with higher P-values were disability, obesity and overweight, and falls. However, the presence of cough on food intake showed significance for MCI (OR = 2.1, CI 95% 1-4.4, P = 0.04). It was observed statistically relevant associations in the presence of cough and the groups with depression (OR = 2.4, 95% CI 1.15-5.16), MCI (OR = 2, 95% CI 1-4), risk of immobility (OR = 2.8, 95% CI 0.0- 8.5), weight loss (OR = 2.3, 95% CI 1-5.5), risk of malnutrition (OR = 15, 95% CI 2.6-85), and chronic pain (OR = 2.2, 95% CI 1.05-4.7).

The presence of choking increased 2 times the probability of depression (95% CI 1-5). The OR for risk of mobility was significant (OR = 3, 95% CI 1-9.7), as was the OR for weight loss and risk of malnutrition (2.6; 16, respectively).

Table 3 displays the results of the multivariate regression analysis for geriatrics syndromes (^bModel 2). The probability of depression was significantly, twice as high in the presence of cough (OR = 2.3, 95% CI 1.05-4.5). The risk of immobility was 3 times more in the presence of choking (P = 0.04). Also for choking OR for weight loss was significant after adjustment (2.7, 95% IC 1.10-6.92). The

dependent variable that showed the highest OR in the multivariate analysis was the risk of malnutrition in the presence of coughing and choking (OR = 14.6, 95% IC 2.4 to 89.66, and OR = 42, 95% IC 3.7 to 486.2, respectively).

4. Discussion

The results showed an association between swallowing disorders (cough and choking) and depression and malnutrition risk prevalence in Mexican elders. By other hand, to the best of our knowledge, this is the first study to associate SD and GS in Mexican elders. These results showed that swallowing impairment is higher in Mexican elders and that their presence could increase the probability of had some GS, even after adjustment for age, sex, literacy, and comorbidities. This result is consistent with previous work, in which the presence of SD can increase the chances of development of negative outcomes in elders^{7,9,15,32}.

In many studies, it was found that the presence of cough or choking increased the risk of depression³³⁻³⁵. In a systematic review, the majority of the studies concluded that symptoms of depression and anxiety were associated with impaired swallowing function³⁶.

Also we showed that coughing and choking could increase the risk of malnutrition. For example, in an analysis made by Budtz-Jørgensen it was found that alterations in chewing caused by oral pathologies were compensated by prolonged mastication and swallowing of a larger volume bolus, which may generate choking sensation during swallowing. This eventually leads to malnutrition due to the unpleasant experience of the feeding process³⁷. As is known malnutrition is associated with a worsening of the state of health in elders, so it is not surprising that deteriorated swallowing function is also linked to negative outcomes, particularly with the presence of GS, as our study showed³⁸. In other studies, the co-occurrence of dysphagia and malnutrition in all health care settings, including community-dwelling older persons were seen in 29% to 45%^{32,39,40}. For example in a study on independently living older persons with OD showed that the percentage of patients with or at risk of MN was 21.7%. Moreover, prevalence of MN at 1-year follow-up rose to 26% in patients with OD⁴¹. In our study, this prevalence reached 68%.

Regarding the association of OD and the risk of immobility found in our study, it seems to be the first report that associates decreased physical performances and swallowing difficulties in elders. In an analysis of an elderly Japanese community, the absence of physical activity (aerobic exercise routine once a week) increased the risk of dysphagia in a cross-sectional study. This risk did not reach statistical significance⁴². Our results, on the other hand, showed statistical significance in both the univariate and multivariate model, and in this last one the cough and choking in swallowing increased to 3 times the risk of immobility (P < 0.005).

Although our study did not studied frailty, we must say that we evaluated components that are recognized as clinical or etiological characteristics of physical frailty, such as

decreased mobility, unintentional weight loss and some depressive symptoms. In our study, OD increased the risk of malnutrition dramatically even after adjustments.

We believe that the biological pathway plausible behind the association between OD and the presence of GS is an altered inflammatory state. It has been shown that higher concentrations of pro-inflammatory cytokines could favor the altered inflammation state observed in GS. In presence of oral pathology, there are an increase in soft tissue injuries or exposure to bacterial endotoxins, pro-inflammatory cytokines, mitogens and viral proteins triggers the immune-inflammatory reactions, such as the arachidonic acid (AA) pathway. Furthermore, there is activation of nuclear factor kappa-B (NF- κ B), which regulates the chronic inflammatory reactions and proinflammatory cytokine production^{43,44}.

Our study has several limitations. First, information on OD was self-reported, and the findings must be interpreted with caution. Further longitudinal studies including objective measures of OD (e.g., barium esophagram, esophageal manometry) should be developed to confirm or refute these findings. Another limitation was the loss of follow-up; this could limit generalization of the findings. The possibility of reverse causality in the direction of the association between OD and physical performance should not be ignored. Finally, validated questionnaires for dysphagia (EAT-10 for example) were not used because the personnel were not trained for their correct performance, and must be taken into account when interpreting these findings. However, the main strengths of this study include GS screening, which was done with standardized tests. Our analysis did consider many other confounding variables; all these factors are well known for their influence on the development of GS.

5. Conclusion

This study showed that the prevalence of OD is higher in Mexican elders. The results suggest the importance of monitoring swallowing function, as they seem to have an impact on health status of the elderly. Adequately recognizing these problems can prevent malnutrition by sending nutritional advice, comprehensive dental evaluation and rehabilitation to avoid complication (malnutrition and risk of aspiration pneumonia, e.g.). So it is important that everyone with dysphagia receive nutritional assessment to identify individuals who have or are at risk for protein-energy malnutrition or specific nutrient deficiencies. We think that CGA, which includes a swallowing evaluation, could be a tool to promote positive changes at the individual level and have the potential to establish therapeutic strategies in multiple levels to prevent deterioration in oral health in the Mexican elderly community, and to avoid the development of some GS. However, these results must be replicated in a more extensive cohort with a longitudinal approach.

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Table 1: Prevalence of swallowing disorder according to the sociodemographic and clinical characteristics

Variable (total)	Swallowing disorder	
	Cough n, (%)	Choking n, (%)
Sex		
Female (154)	24 (16)	26 (17)*
Male (106)	10 (9.4)	6 (6)*
Age, years		
60-74 (176)	24 (14)	22 (13)
75-84(84)	8 (10)	9 (11)
85+ (4)	2 (50)	1 (25)
Marital status		
Married (165)	21 (13)	21 (13)
Widowhood (75)	11 (15)	10 (13)
Smoking		
Yes (94)	12 (13)	12 (13)
No (167)	22 (13)	20 (12)
Depression (GDS >5)		
Yes (65)	14 (22)*	13 (20)*
No (194)	20 (10)*	19 (10)*
MCI (MMSE <23)		
Yes (96)	18 (19)*	16 (17)
No (164)	16 (10)*	16 (10)
Pain		
Yes (125)	22 (18)*	19 (15)

No (136)	12 (9)*	13 (10)
Immobility High Risk		
Yes (18)	5 (28)	5 (28)*
No (242)	29 (12)	26 (11)*
Disability (Barthel)		
Yes (7)	2 (29)	1 (14)
No (254)	32 (13)	31 (12)
Lawton (Male Disability)		
Yes (189)	23 (12)	22 (12)
No (72)	11 (15)	10 (14)
Lawton (Female Disability)		
Yes (123)	18 (15)	16 (13)
No (138)	16 (12)	16 (12)
Obesity		
Yes (77)	6 (8)	8 (10)
No (183)	28 (15)	23 (12)
Overweight		
Yes (58)	10 (17)	10 (17)
No (202)	22 (11)	21 (10)
Weight Loss (Last Year)		
Yes (39)	9 (23)*	9 (23)*
No (222)	25 (11)*	23 (10)*
Nutritional Risk (DNA>6)		
Yes (6)	4 (68)*	4 (68)*
No (255)	30 (12)*	28 (11)*

GDS: Geriatric Depression Scale, MCI: Mild Cognitive Impairment MMSE: Mini Mental State Evaluation, DNA: Questionnaire for the detection of malnutrition in older adults. * P < 0.05

Table 2: Univariate Regression Logistic Analyses of geriatrics syndromes by Swallowing disorder variables

Variable	Swallowing disorder			
	Cough		Choking	
Geriatric Syndrome scores, per SD	OR	P	OR	P
Falls	1.3 (0.6-2.6), 0.5		1 (0.5-2.29), 0.85	
Depression (GDS>6)	2.4 (1.15-5.16), 0.02*		2.30 (1-5), 0.03*	
Disability				
ADL (Lawton)				
Female	1.3 (0.6-2.6), 0.48		1.14 (0.54-2.4), 0.72	
Male	0.77 (0.35-1.7), 0.5		0.81 (0.37-1.82), 0.62	
IADL (Barthel)	2.7 (0.5-15), 0.23		1.2 (0.14-10), 0.87	
MCI (MMSE<23)	2.12 (1-4.4), 0.043*		1.85 (0.88-3.9), 0.10	
Mobility (Rosow-Breslow)	2.8 (0.9-8.5), 0.05*		3.20 (1-9.7), 0.04*	
Malnutrition				
Obesity	0.5 (0.2-1.2), 0.11		0.80 (0.34-1.89), 0.6	
Overweight	1.5 (0.7-3.4), 0.3		1.79 (0.8-4.06), 0.16	
Weight loss	2.35 (1-5.5), 0.04*		2.6 (1.09-6.1), 0.03*	
Malnutrition risk (DNA)	15 (2.6-85), 0.002*		16 (2.8-92.6), 0.002*	
Pain	2.2 (1.05-4.7), 0.03*		1.7 (0.8-3.6), 0.17	

^aModel 1: Univariate by Swallowing disorder variables

GDS: Geriatric Depression Scale, ADL: Activities Daily Living, IADL: Activities Daily Living, MCI: Mild Cognitive Impairment MMSE: Mini Mental State Evaluation, DNA: Questionnaire for the detection of malnutrition in older adults. * P < 0.05

Table 3: Multivariate Regression Logistic Analyses of geriatrics syndromes by Swallowing disorder variables

Variable	Swallowing disorder			
	Cough		Choking	
Geriatric Syndrome scores, per SD	OR	P	OR	P
Depression (GDS)	2.28 (1.056-4.5), 0.030*		2.31 (0.98-5.4), 0.04*	
MCI	2.02 (0.93-4.40), 0.07		-	
Mobility (Rosow-Breslow)	2.56 (0.79-8.32), 0.11		3.5 (1.024-12.3), 0.04*	

Malnutrition	2.12 (0.88-5.1), 0.09	2.76 (1.101-6.92), 0.03*
Weight loss	14.6 (2.4-89.66), 0.004*	42 (3.7-486.2), 0.002*
Malnutrition risk (DNA)	2.03 (0.93-4.4), 0.072	-
Pain		

^bModel 2: Model Univariateplus adjusted by age, sex and literacy.

GDS: Geriatric Depression Scale, *MCI*: Mild Cognitive Impairment, *DNA*: Questionnaire for the detection of malnutrition in older adults. * P < 0.05

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Elements of Financial/Personal Conflicts	JADR		MIMC		YCJA		CFA		VMRA		EAC		DLM	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Employment or Affiliation		X		X		X		X		X		X		X
Grants/Funds		X		X		X		X		X		X		X
Honoraria		X		X		X		X		X		X		X
Speaker Forum		X		X		X		X		X		X		X
Consultant		X		X		X		X		X		X		X
Stocks		X		X		X		X		X		X		X
Royalties		X		X		X		X		X		X		X
Expert Testimony		X		X		X		X		X		X		X
Board Member		X		X		X		X		X		X		X
Patents		X		X		X		X		X		X		X
Personal Relationship		X		X		X		X		X		X		X

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