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Multiple Sclerosis and Related Disorders

journal homepage: www.elsevier.com/locate/msard

Original article

The prevalence and types of oral- and pharyngeal-stage dysphagia in patients with demyelinating diseases based on subjective assessment by the study subjects



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ARTICLE INFO

Keywords:

Multiple sclerosis

Devic's syndrome

Deglutition

Swallowing disorders

ABSTRACT

Background: Studies show that dysphagia is a common problem in patients with demyelinating diseases. However, there are no published studies on dysphagia in this group of patients, which would include the individual phases or the safety and effectiveness of the swallowing process.

Objective: The main objective of this study was to assess the prevalence of swallowing disorders and to characterize them based on subjective assessment by the study subjects with multiple sclerosis and Devic's syndrome.

Method: The study included 72 patients (47 F, 25 M). Patients at risk of dysphagia were identified using the DYMUS, EAT-10 and SDQ questionnaires. To assess the type of oral- and pharyngeal-stage dysphagia, questions in the questionnaires were classified into groups according to symptoms typical of each stage.

Results: The risk of dysphagia and the need for instrumental examination were identified in 37.5% of the study subjects. Pharyngeal-stage dysphagia (repeated swallowing, increased effort of swallowing, cough, a feeling of food sticking in the throat) was reported to occur at a significantly higher frequency. However, no differences were found between difficulty in swallowing liquids and difficulty in swallowing solid food.

Conclusion: There is a need for further research, which should include a detailed dysphagia-oriented diagnosis, with a view to gaining a detailed insight into the pathophysiology of deglutition in this group of patients.

1. Introduction

Multiple sclerosis (MS) is a common disease that involves demyelination. The prevalence of neurogenic dysphagia in this group of patients is estimated to be more than 30% (Guan et al., 2015). Aghaz et al. showed in their meta-analysis that the prevalence of dysphagia was 37.2% according to studies based on subjective methods of assessment or as much as 58.4% according to studies based on objective methods of assessment (Aghaz et al., 2018). As highlighted by a number of authors, the prevalence of dysphagia varies according to the type of MS, disability score determined based on the Expanded Disability Status Scale (EDSS), disease duration and the assessment tool used in a study (Guan et al., 2015; Calcagno et al., 2002; Fernandes et al., 2013; Poorjavad et al., 2010). The existing data seem to be inconsistent with respect to severity of dysphagia, types of related disorders, including in

particular the phases, effectiveness and safety of swallowing of food of various consistency. Given the complications associated with dysphagia, such as malnutrition, dehydration, aspiration pneumonia and reduced quality of life, it is important to identify the relevant symptoms at an early stage and to enable patients to participate in rehabilitation programs, with particular emphasis on adaptive methods (Poorjavad et al., 2010). Therefore, the objective of this study was to assess the prevalence and characteristics of dysphagia in patients with demyelinating diseases based on their subjective assessment.

2. Material and methods

The study included 72 patients with demyelinating diseases, aged 23 to 72 years, hospitalized in the Department of Neurology at Medical University Hospital in Warsaw. The study was carried out during the

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<https://doi.org/10.1016/j.msard.2019.101484>

Received 10 July 2019; Received in revised form 18 October 2019; Accepted 28 October 2019

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period from January to May 2019. The inclusion criteria for the study were defined as follows: a diagnosed disease of the central nervous system, classified as a demyelinating disease in accordance with the ICD-10 system, and a signed consent for participation in the study. Patients on enteral (PEG or feeding tube) or parenteral nutrition and patients whose health status prevented them from responding to questionnaires were excluded from the study.

The study was approved by the local Ethics Committee Review Board of the Medical University of Warsaw (KB/39/A/2016). Completion of the survey meant that the patients gave their consent to participate in this study.

To assess the prevalence of dysphagia, the following screening questionnaires were used: DYMUS (DYsphagia in MUltiple Sclerosis) (Bergamaschi et al., 2008), EAT-10 (Eating Assessment Tool) (Belafsky et al., 2008) and SDQ (Swallowing Disturbance Questionnaire) (Jacob et al., 2011). We used Polish version of these questionnaires. The questionnaires had internal consistency and a reliability coefficient (Cronbach's alpha) of 0.79–0.83.

The study subjects were divided into two subgroups according to swallowing disorders: patients without dysphagia were classified into Group 1 while patients with dysphagia – into Group 2. It was assumed that patients meeting one of the 3 criteria listed below would be classified into the dysphagia group.

- the SDQ score ≥ 12.5 points (Jacob et al., 2011);
- the DYMUS score ≥ 3 points (Bergamaschi et al., 2008);
- the EAT-10 score ≥ 3 points (Belafsky et al., 2008).

To assess the prevalence and the type of oral- and pharyngeal-stage dysphagia, questions in the questionnaires were divided according to symptoms typical of each stage (Table 1).

2.1. DYMUS (DYsphagia in MUltiple sclerosis)

The DYMUS questionnaire consisted of 10 questions concerning the physiology of the swallowing process as well as the consequences of related abnormalities: cough, weight loss, the need to mash food, including questions about difficulty in swallowing solid food (7 questions: 1,3,4,6,9,10,14) and difficulty in swallowing liquids (3 questions: 2,7,11). Almost all questions referred to the effectiveness of swallowing, except the last question (number 15) about weight loss over the last 6 months. The patients were asked to respond ‘yes’ or ‘no’ to the questions to indicate that they had or, respectively, that they did not have the relevant symptom (Bergamaschi et al., 2008). The DYMUS score ≥ 3 points was taken as an abnormal result.

2.2. EAT-10 (Eating assessment tool)

The EAT-10 questionnaire consisted of 10 questions. The patients were asked to respond to all the statements in the questionnaire and to assess the severity of the respective problems on a scale of 0 to 4, where 0 indicated no problems and 4 – severe problems. Most of the questions concerned the physiology of the swallowing process, including 3 questions about psychosocial impact: stress associated with swallowing, reduced pleasure of eating, possibility of going out for meals

Table 1
Classification of questions in the questionnaires used in the study according to swallowing phase.

Questionnaire	Oral phase (question number)	Pharyngeal phase (question number)
EAT-10	–	3, 4, 8, 9
DYMUS	–	1, 2, 3, 4, 6, 7, 9
SDQ	1–5	6–14

(Belafsky et al., 2008). The EAT-10 score ≥ 3 points was taken as an abnormal result.

2.3. SDQ (Swallowing disturbance questionnaire)

The SDQ questionnaire consisted of 15 questions concerning the incidence of oral- and pharyngeal-stage symptoms of dysphagia. Questions 1–5 referred to oral-stage dysphagia while questions 6–14 – to pharyngeal-stage dysphagia. Questions 1–14 were scored on a 4-grade scale of 0 to 3 (where 0 indicated no disorders and 3 – severe disorders). All the responses were scored as follows:

- 0 points – response ‘never’;
- 1 point – response ‘rarely (\geq once per month)’;
- 2 points – response ‘often (1–7 times per week)’;
- 3 points – response ‘very often ($>$ 7 times per week)’.

The last question (number 15) was a yes-no question that was scored at 0.5 points if the response was ‘no’ and at 2.5 points if the response was ‘yes’. The score of ≥ 12.5 points was taken as a cut-off score that is indicative of possible swallowing disorders and the need for further specialist tests for dysphagia (Jacob et al., 2011).

The study results were analyzed using the software package SPSS 17.0. The following statistical tests were used: chi-squared test, logistic regression analysis, Spearman's rank correlation (*p*-value) test, Cochran's Q test and McNemar's test. The adopted statistical significance level was $P < 0.05$.

3. Results

The study included 64 patients with multiple sclerosis and 8 patients with Devic's syndrome. Swallowing disorders were identified in 27 of the study subjects (37.5%). The characteristics of the group is shown in Table 2 and the prevalence of dysphagia according to screening questionnaire is shown in Table 3.

It was demonstrated that there were no statistically significant differences between the results of the DYMUS and the EAT-10 questionnaires in terms of how often swallowing disorders were identified. However, statistically significant differences were found between the frequency of detection of swallowing disorders using the SDQ and EAT-10 questionnaires and the SDQ and DYMUS questionnaires ($p = 0.0008$ and $p = 0.0024$ respectively)

No statistically significant differences in the prevalence of dysphagia were observed between females and males. No correlations were observed between the age of the study subjects or the disease duration and the prevalence of dysphagia based on the results of logistic regression analysis.

3.1. Oral phase

It was demonstrated that oral-stage dysphagia was a rare occurrence

Table 2
Characteristics of the study group and the prevalence of dysphagia.

Subjects per group	Group 1 <i>n</i> = 45	Group 2 <i>n</i> = 27
Characteristics of the study group:		
– males, <i>n</i> (%)	17 (37.7)	8 (29.6)
– females, <i>n</i> (%)	28 (62.2)	19 (70.4)
– mean age \pm SD (min-max) (years)	43.7 \pm 10.2 (23–72)	45.0 \pm 11.8 (25–70)
Disease:		
– multiple sclerosis, <i>n</i> (%)	41 (91.1)	23 (70.4)
– Devic's syndrome, <i>n</i> (%)	4 (8.9)	4 (14.8)
Disease duration (mean \pm SD (years))	8.6 \pm 7.42	11.9 \pm 7.61

Table 3

The prevalence of dysphagia in all the study subjects according to questionnaire, including the criteria used for identification of swallowing disorders and mean scores ($n = 72$).

Questionnaire	Cut-off score for diagnosing dysphagia	Maximum achievable score	Mean score (min-max)	Prevalence of dysphagia% (n)
EAT-10	≥ 3 points	40 points	3.33 points (0–29)	34.7% ($n = 25$)
DYMUS	≥ 3 points	10 points	2.0 points (0–9)	31.9% ($n = 23$)
SDQ	≥ 12.5	44.5 points	7.1 points (0.5–35.5)	11.1% ($n = 8$)

Table 4

The incidence of symptoms of oral-stage dysphagia.

Symptoms of dysphagia	Total $N = 72$	Group – 1 $N = 45$	Group – 2 $N = 27$	λ	df	p
Difficulty in chewing, n (%)	4 (5.6)	0 (0)	4 (14.8)	8.4**	1	0.004
Retention of food in the mouth, n (%)	9 (12.5)	2 (4.4)	7 (25.9)	6.99**	1	0.008
Leaking of food from the mouth	5 (6.9)	1 (2.2)	4 (14.8)	4.07*	1	0.044
Excessive saliva	12 (16.7)	5 (11.1)	7 (25.9)	2.58	1	0.108

N – number of subjects;% – percentage of the group; λ – likelihood ratio; df – number of degrees of freedom; p – statistical significance; * – $p < 0.05$; ** $p < 0.01$; *** – $p < 0.001$.

in the entire study group. The related symptoms most often included excessive saliva in the mouth (16.7%, 12/72), retention of food in the mouth and regurgitation into the nose (9/72 and 8/72 respectively). The most frequent oral-stage problems in the dysphagia group (Group 2) were excessive saliva and retention of food in the mouth, reported by 25.9% (7/27) of the study subjects, as well as regurgitation into the nose (5/27). Difficulty in chewing food and leaking of food from the mouth were reported by 14.8% (4/27) of the study subjects (Table 4).

The symptoms of dysphagia that occurred very often (at least once per day), as reported by the patients classified into Group 2, included difficulty in chewing, retention of food in the mouth and excessive saliva. This problem was reported by 2 patients. All the study subjects who experienced oral-stage dysphagia of any kind at least once per week (often and very often) were classified into Group 2. The regurgitation of food from the mouth into the nose, reported by 4 patients, was usually observed no more than once per month. The other symptoms were observed less frequently or were not observed at all.

3.2. Pharyngeal phase

3.2.1. Food consistency

The study subjects classified into Group 2 reported that they had the greatest difficulty in swallowing solid food (66.7%), followed by difficulty in swallowing liquids (51.9%), while swallowing mashed food was considered least difficult (33.3%).

Based on Cochran's Q test results, it was found that there were statistically significant differences in the incidence of the individual swallowing problems ($Q(2) = 9.38, p < 0.01$). The pairwise comparisons based on McNemar's test showed statistically significant differences between the incidence of difficulty in swallowing solid food and the incidence of difficulty in swallowing mashed food ($p > 0.01$). All the patients who experienced difficulty in swallowing mashed food also had problems with swallowing solid food (100%) ($\lambda 9.42, p = 0.002$). However, no statistically significant differences were identified between the incidence of difficulty in swallowing liquids and the incidence of difficulty in swallowing solid food, even though problems associated with swallowing liquids were concomitant with difficulty in swallowing mashed food (57.1%) ($\lambda 8.20, p = 0.004$).

The main problem with swallowing solid food, as reported by the study patients, was the need to repeatedly swallow food, even though it was thoroughly masticated. This problem was reported by 30.6% of the study subjects. Only few of the study subjects (9.7%) experienced this problem during swallowing liquids. One fourth of the study subjects (25%) declared that swallowing causes cough, whatever the consistency of food being swallowed.

Based on the results for the entire group of the study subjects, the increased effort of swallowing was slightly more often associated with swallowing solid food (22.2%) than liquids (18.1%). The retention of food in the throat was indicated by nearly one fourth of all the study subjects (23.6%). In Group 2, problems with swallowing, similarly to what was observed in the group of all the study subjects, were mostly associated with the need to repeatedly swallow solid food (74.1%), which was much less frequently required during swallowing liquids (14.8%). In the dysphagia group, similarly to the group of all the study subjects, the increased effort of swallowing was slightly more often associated with swallowing solid food (59.3%) than liquids (48.1%). Even though patients in Group 2 complained more frequently about the need to repeatedly swallow solid food and the resulting increased effort of swallowing, cough after drinking liquids was reported in this group slightly less often than after eating solid food (56.3%). The retention of food in the throat was indicated by more than half of all the study subjects (56.3%) (Table 5). Table 6 shows the distribution of incidence of symptoms after drinking liquids or eating solid food. The summary includes the results of χ^2 test. Statistically significant correlations are indicated by asterisks (Table 6).

N – number of subjects;% – percentage of the group; λ – likelihood ratio; df – number of degrees of freedom; p – statistical significance; * – $p < 0.05$; ** $p < 0.01$; *** – $p < 0.001$.

Statistically significant correlations were also observed between the incidence of cough and the increased effort of swallowing, whether solid food or liquids ($\chi^2 6.68, p < 0.01$, and $\chi^2 15.96, p < 0.001$, respectively). Cough while swallowing liquids and/or solid food was reported by 55.6% of the study subjects classified into Group 2. On the other hand, the increased effort of swallowing liquids and/or solid food was reported by 40.7% of the patients.

3.2.2. Difficulty in swallowing solid food

The study showed that 26.4% (19/72) of the study patients with demyelinating diseases and more than half of the patients in Group 2 (66.7%) declared that they had difficulties in swallowing solid food, and more than one third of them (10/27) reported to have observed such difficulties at least once per week (often or very often).

The retention of food in the throat was considered a problem by 23.6% (17/72) of all the study subjects and more than half of patients classified into Group 2 (16/27). Nearly one third of patients with dysphagia (8/27) experienced this problem at least once per week (often and very often), however, the same percentage of the study subjects (8/27) reported that it was a rare occurrence (no more than once per month).

None of the patients who were asked to assess the severity of food

Table 5
The incidence of symptoms of pharyngeal-stage dysphagia.

Symptoms of dysphagia	Total N = 72 N (%)	Group – 1 N = 45 N (%)	Group – 2 N = 27 N (%)	λ	df	p
Need to repeatedly swallow solid food	22 (30.6)	2 (4.4)	20 (74.1)	41.36***	1	0.000
Need to repeatedly swallow liquids	7 (9.7)	0 (0)	7 (25.9)	15.02***	1	0.000
Increased effort of swallowing solid food	17 (23.6)	1	16	32.61***	1	0.000
Increased effort of swallowing liquids	14 (19.4)	1	13	23.95	1	0.000
Cough during eating solid food	18 (25)	2 (4.4)	16 (59.3)	28.11***	1	0.000
Cough during drinking liquids	18 (25)	1 (2.2)	17 (63)	35.79***	1	0.000
Retention of food in the throat	17 (23.6)	1 (2.2)	16 (59.3)	32.61	1	0.000
Difficulty in swallowing solid food	19 (26.4)	1 (2.2)	18 (66.7)	32.84***	1	0.000
Difficulty in swallowing liquids	14 (19.4)	0 (0)	14 (51.9)	33.54***	1	0.000
Difficulty in swallowing mashed food	9 (12.5)	0 (0)	9 (33.3)	19.88***	1	0.000
Regurgitation into the nose	8 (11.1)	3 (6.7)	5 (18.5)	2.31	1	0.128
Voice changes	16 (22.2)	4 (8.9)	12 (44.4)	12.19***	1	0.000

Table 6
The distribution of incidence of symptoms after drinking liquids or eating solid food and results of statistical significance test in Group 2 (n = 27).

Symptoms of dysphagia	Liquids n %	Solid food n %	Total n %	Test χ^2	df	p
need to swallow repeatedly	7 25.9	20 74.1	27 50.0	12.52***	1	0.001
increased effort of swallowing	13 48.1	16 59.3	29 53.7	0.67	1	0.413
cough	17 63.0	16 59.3	33 61.1	0.08	1	0.780

n – number of subjects; % – percentage of the group; χ^2 – statistical test; df – number of degrees of freedom; p – statistical significance; *** – $p < 0.001$.

retention of in the throat considered this problem to be severe (4 points on the EAT-10 scale), even though 4% of the patients declared that they experienced it on a daily basis. Additionally, even though 29% (8/27) of the patients in Group 2 reported that the problem of food retention in the throat was observed less frequently than once per month, only 19% of them (5/27) considered this problem to insignificant (1 point on the EAT-10 scale). Despite those differences, a statistically significant correlation was found between the incidence of food retention according to the SDQ questionnaire and the severity of this symptom according to the EAT-10 questionnaire ($\rho = 0.849, p < 0.001$).

The intake of solid food was associated with increased effort of swallowing in 22.2% (16/72) of all the study subjects. Whenever food retention of in the throat was reported, the reporting subject was classified into Group 2, and therefore the percentage of patients experiencing this problem was 59.3% (16/27) in Group 2.

The increased effort of eating solid food in Group 2, if considered a problem, was still assessed as insignificant by a large number of the patients (10/27) (1 point on the EAT-10 scale).

3.2.3. Difficulty in swallowing liquids

Drinking liquids was reported to be associated with greater effort by 18.1% (13/72) of all the study subjects and all these patients were classified into the dysphagia group (Group 2), and therefore drinking liquids was associated with greater effort in nearly half of the study subjects (13/27) in Group D. Only 11.1% (3/27) of the subjects who reported that drinking liquids was associated with increased effort also considered this problem to be insignificant (1 point on the EAT-10 scale).

3.2.4. Difficulty in swallowing mashed food

All the study subjects (9/72) who experienced difficulty in swallowing mashed food were classified into Group 2. In general, problems with swallowing mashed food, if any, were not considered a nuisance and they were observed less frequently than once per month. Nearly

half of the study subjects with dysphagia (44.4%) declared that food broken down into smaller pieces is easier to swallow.

3.2.5. Cough during meals

Cough after eating solid food and/or drinking liquids was reported by 29.2% of all the study subjects (21/72) and affected 66.7% (18/27) of the patients classified into the dysphagia group (Group 2). Cough after eating solid food was reported by 25% of all the study subjects and only 2 persons presenting this symptom were not classified into Group 2. Cough associated with drinking liquids was also reported by one fourth of the study subjects and only one patient not classified into the dysphagia group (Group 2).

Cough after drinking liquids and eating solid food was reported by 20.8% of the study patients with demyelinating diseases (15/72) and all of them were classified into Group 2. A total of 55.5% of the study subjects classified into this group (15/27) had problems associated with cough after drinking liquids as well as eating solid food ($p = 0.00006$).

Nearly one third of the study subjects (29.6%) classified into the dysphagia group complained about occasional (≤ 1 per month) cough after eating solid food and/or drinking liquids. Cough after meals, regardless of food consistency, occurring at least once per week (often and very often), was also reported by about one third of the patients in Group 2 – after drinking liquids by 33.3% and after eating solid food by 29.6%. It should be noted that nearly one fifth of the study subjects (18.5%) observed cough after drinking liquids at least once per day.

Nearly one third of the study subjects (7/27) classified into Group 2, who were asked to score the statement ‘I cough during meals’, admitted that cough associated with eating is quite a serious problem (3 points on the EAT-10 scale). Only 7% (2/27) of the study subjects described cough during meals as a minor problem (1 point on the EAT-10 scale). According to 15% (4/27) of the study subjects assigned to Group 2, cough was a serious problem (4 points on the EAT-10 scale).

The incidence of cough after drinking liquids was more strongly correlated with the severity of cough as compared to the incidence of cough after eating solid food. Spearman’s rank correlation coefficients ρ were $\rho = 0.875, p < 0.001$, and $\rho = 0.679, p < 0.001$, respectively. The resulting difference between the correlation coefficients was statistically significant based on the Z test results ($Z = 2.26, p < 0.05$).

3.2.6. Voice changes after meals

Voice changes such as hoarseness or changes in voice loudness, observed immediately after drinking liquid or eating solid food, were reported by 22.2% (16/72) of all the study subjects. Such changes were observed by 44.4% (12/27) of the subjects classified into the dysphagia group. Voice changes after meals were usually observed less frequently than once per month.

4. Discussion

Demyelinating diseases are a group of disorders that may affect the swallowing process due to the damage of the myelin sheath and the resulting disruption of nerve conduction (Calcagno et al., 2002). Previous studies have confirmed that dysphagia is a frequent, even though sometimes unnoticed, problem in people with multiple sclerosis (Abraham et al. 2002; Calcagno et al., 2002; Pauw et al., 2002; Wiesner et al., 2002; Poorjavand et al., 2010; Solaro et al., 2013) which is the most common condition classified as a demyelinating disease of the central nervous system in accordance with the ICD-10 system.

In this study, swallowing disorders were assessed based on standardised screening questionnaires: EAT-10, DYMUS and SDQ, that had been shown during their validation to present a high degree of internal coherence as well as sensitivity and specificity as compared to instrumental methods (Belafsky et al., 2008; Bergamaschi et al., 2008; Jacob et al., 2011). Additionally, all the questionnaires were adjusted for use in a population of patients with neurodegenerative diseases, and the results of the DYMUS questionnaire demonstrated its internal coherence with respect to the population of MS patients (Bergamaschi et al., 2008; Bergamaschi et al., 2009).

The results of this study showed that there were no statistically significant differences between the DYMUS and the EAT-10 questionnaires in terms of identification of swallowing disorders in patients with demyelinating diseases, which suggests that both questionnaires can be used for this purpose. The results of the analysis of differences in the prevalence of swallowing disorders in the study group based on the SDQ questionnaire showed a statistically significant lower incidence of swallowing disorders identified using this questionnaire as compared to the DYMUS and EAT-10 questionnaires. This suggests that in patients with demyelinating diseases, results of the SDQ questionnaire should be considered in combination with results of other questionnaires as well as compared with results of reference methods designed for dysphagia identification and assessment.

Using an abnormal result of at least one of the questionnaires used in the study as an eligibility criterion for classification into the dysphagia group, it was demonstrated that 37.5% of the study subjects had swallowing disorders. Even though the study group was extended to include patients with Devic's syndrome, the study result was within the range of 24% – 55%, which corresponds to results obtained by other authors studying the prevalence of swallowing disorders in patients with multiple sclerosis (Calcagno et al., 2002; Pauw et al., 2002; Poorjavand 12–16, 18–21, Alali 2018). However, studies into the prevalence of swallowing disorders in MS patients, which used such assessment methods as videofluoroscopy swallowing study (VFSS), show that dysphagia is observed in nearly all MS patients examined using this method and the related results are significantly higher than those obtained in this study (Fernandes et al., 2013; Wiesner et al., 2002; Abraham et al. 2002).

Surprisingly, the results of this study demonstrated higher incidence of the dysphagia symptoms referred to in the DYMUS questionnaire as compared to findings published by other authors who used the same questionnaire for the assessment of swallowing disorders in MS patients (Bergamaschi et al., 2008; Bergamaschi et al., 2009; Solaro et al., 2013). Bergamaschi et al. (2008) used the result of ≥ 3 positive responses to the DYMUS questionnaire as a cut-off score and an alarming sign that is indicative of dysphagia. In this study, an abnormal result of the DYMUS questionnaire (≥ 3 points) was obtained by 31.9% of the patients while more than half of the study subjects (55.5%) responded yes to at least one question. In the study of Bergamaschi et al., the result of ≥ 3 points was obtained by 25.2% of the study subjects as compared to 35% of MS patients giving positive response to at least one question in the questionnaire in the study of Bergamaschi et al. in 2008 [18] and 31% in a study conducted one year later by the same authors, but on a larger group of study subjects (Bergamaschi et al., 2009). Solaro et al. also demonstrated that 31.3% of the subjects included in their study

had dysphagia (Solaro et al., 2013).

The differences between the results of this study and those reported by other authors who used the DYMUS questionnaire as their assessment tool can be attributed to the smaller number of study subjects or the inclusion of patients with Devic's syndrome. Nonetheless, there are few references concerning dysphagia associated with Devic's syndrome.

Some researchers highlight the demonstrated correlation between the type of multiple sclerosis (Fernandes et al., 2013; Poorjavand et al., 2010) and the level of physical mobility (according to the EDSS score) (Bergamaschi et al. 2009; Fernandes et al., 2013; Pauw et al., 2002; Poorjavand et al., 2010), and the prevalence of swallowing disorders, and the lack of information on those factors is a limitation of this study, which can also be the reason for differences between our findings and those of other studies involving the use of the DYMUS questionnaire.

The results of this study demonstrate that pharyngeal-stage dysphagia occurs more frequently to a statistically significant degree as compared to oral-stage disorders. This corresponds to the findings reported by Poorjavand et al. (2010), Wiesner et al. (2002) and Abraham et al. (2002), who used instrumental methods. However, these results are inconsistent with those obtained by Colagno et al. [15] and Pauw et al. (Pauw et al., 2002), who considered that oral-stage swallowing disorders were experienced by nearly all patients with MS and moderate dysphagia while pharyngeal-stage swallowing disorders tended to be associated with more advanced dysphagia. These differences can also be explained by the number of subjects who participated in the study. This study as well as those carried out by Poorjavand et al. (2010), Wiesner et al. (2002) and Abraham et al. (2002) included smaller study groups as compared to studies conducted by Colagno et al. (2002) and Pauw et al. (2002). The instrumental or interview methods used in the said studies had no impact on the relevant findings.

The absence of statistically significant differences in the incidence of difficulties in swallowing solid and liquid food, as demonstrated in this study, corresponds to the assumption that neurogenic dysphagia can manifest itself both by difficulties in drinking liquids and difficulties in eating solid food. This shows the need for more detailed examination of patients with neurological conditions for dysphagia using instrumental methods so as to provide them with appropriate adaptive techniques, including nutritional therapy.

The high number of differences between findings concerning dysphagia in MS patients indicates the need for further research in this area. It seems to be of particular importance, given the close correlation between the prevalence of dysphagia and the consequences which might be observed in patients without dysphagia-oriented rehabilitation. Results of a randomized study have only highlighted the higher effectiveness of sensorimotor exercises and swallowing maneuvers in relation to diet adjustment and postural changes (Tarameshlu et al., 2019).

5. Limitations of the study

One of the limitations was the insufficient number of study subjects, which makes it difficult to extrapolate the results into the entire population of patients with demyelinating diseases. Additionally, only the duration of the underlying disease was taken into account in this study while the severity of the disease and the type of MS were not considered. The study used no instrumental methods for dysphagia assessment, and therefore it was impossible to perform an in-depth analysis of the pathophysiology of deglutition in this group of patients.

6. Summary and conclusions

- 1 It was demonstrated that 37.5% of the study subjects experienced swallowing disorders, which shows that their prevalence is quite high in the general population of patients with demyelinating diseases and indicates the need for continuous monitoring of these

patients for dysphagia.

- 2 The results of the screening questionnaires used in the study showed that pharyngeal-stage dysphagia is observed more frequently than oral-stage dysphagia to a statistically significant degree. It is recommended that swallowing disorders should be assessed on a regular basis in daily practice and diagnosis methods should be extended to include instrumental tests.
- 3 Given the differences between the results obtained using different screening tools, it is suggested that multiple tools designed for this group of patients should be used.
- 4 No statistically significant differences were identified between the incidence of dysphagia symptoms in the study patients with demyelinating diseases after eating solid food and drinking liquids, which suggests the need for a more detailed diagnosis of dysphagia in patients whose screening results were abnormal. The lack of detailed information about what food consistency affects the effectiveness of swallowing makes it impossible to produce appropriate nutritional recommendations in terms of food consistency.

Declaration of Competing Interest

None declared.

Funding

The study was financed from own funds.

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