Validation of the DYMUS questionnaire for the assessment of dysphagia in multiple sclerosis

Roberto Bergamaschi, MD
Cristiana Rezzani, PhD
Simona Minguzzi, RN
Maria Pia Amato, MD
Francesco Patti, MD
Maria Giovanna Marrosu, MD, PhD
Simona Bonavita, MD
Maria Grazia Grasso, MD
Angelo Ghezzi, MD
Maria Luisa Stromillo, MD
Cristina Montomoli, PhD
Claudio Solaro, MD

and the DYMUS Group1

* Multiple Sclerosis Centre, IRCCS “C. Mondino Institute of Neurology”, Pavia, Italy
b Section of Medical Statistics and Epidemiology, Department of Health Sciences, University of Pavia, Italy
c Department of Neuroscience, Ophthalmology and Genetics, University of Genoa, Italy
d Department of Neurological and Psychiatric Sciences, University of Florence, Italy
e Department of Neurology, University of Catania, Italy
f Department of Neuroscience, University of Cagliari, Italy
g Department of Neurological Sciences, II University of Naples, Italy
h IRCCS Santa Lucia Foundation, Rome, Italy
i Multiple Sclerosis Centre, S. Antonio Abate Hospital, Gallarate, Italy
j Multiple Sclerosis Centre, Bergamo Hospital, Bergamo, Italy
k Department of Neuroscience, S Camillo-Fortanini Hospital, Rome, Italy
l Division of Neurology, Garibaldi Hospital, Catania, Italy
m Division of Neurology, “San Raffaele” Scientific Institute and University Hospital, Milan, Italy
n Department of Neurological and Behavioural Sciences, University of Siena, Italy
o Division of Neurology, ASL3 Genovese, Genoa, Italy

Corresponding author: Roberto Bergamaschi
Multiple Sclerosis Centre, Department of Clinical Neurology “C. Mondino Institute of Neurology” Foundation Via Mondino 2 - 27100 Pavia, Italy
e-mail: roberto.bergamaschi@mondino.it

Summary

Swallowing problems can complicate the course of multiple sclerosis (MS). However, no validated questionnaire for the assessment of dysphagia in MS is currently available. We previously developed a 10-item DYsphagia in Multiple Sclerosis questionnaire (DYMUS). In the present study, this questionnaire was submitted to a validation process. Thirteen Italian MS centres took part in this research in which DYMUS was administered to 1734 consecutive MS patients during routine checkups outside relapse. The questionnaire showed very good internal consistency (Cronbach’s alpha = 0.914). It was then subdivided into two subscales, both of which also showed very good internal consistency: Cronbach’s alpha was 0.885 for the ‘dysphagia for solids’ subscale and 0.864 for the ‘dysphagia for liquids’ subscale. The DYMUS questionnaire was found to be an easy and reliable tool for detecting dysphagia and also for the preliminary selection of patients requiring more specific instrumental analyses, and those suitable for aspiration prevention programmes.

KEY WORDS: dysphagia, multiple sclerosis, questionnaire.

Introduction

Dysphagia is a relatively common symptom in multiple sclerosis (MS) (1-4) in which it can potentially cause severe problems (5). It would be helpful to have a reliable tool available for the preliminary screening and quantification of swallowing problems in MS patients, in order to identify those who should be submitted to further and more specific instrumental investigations, such as videofluoroscopy (6). However, no validated questionnaire for the assessment of dysphagia in MS is currently available. The only ad hoc instrument of this type is the recently developed DYMUS (DYsphagia in
Multiple Sclerosis) questionnaire (7). The purpose of the present study was to validate DYMUS in a large sample of patients.

Materials and methods

The questionnaire

The DYMUS questionnaire was developed by a committee of Italian neurologists with specific expertise in the field of MS and, in a pilot phase, administered to 226 MS patients (7). The questionnaire was the end result of a complex process (item analysis, study of dimensionality, reliability analysis), which took as its starting point a more extensive questionnaire. DYMUS is a 10-item questionnaire; all the answers are dichotomous, coded as 1 or 0, depending on the presence or the absence of the event (Appendix). In the preliminary study DYMUS showed very good internal consistency (Cronbach's alpha = 0.877). In addition, factor analysis allowed us to subdivide DYMUS in two subscales, ‘dysphagia for solids’ and ‘dysphagia for liquids’, both of which also showed very good internal consistency (Cronbach's alpha 0.852 and 0.870, respectively). Nevertheless, in order to confirm the consistency and the reliability of DYMUS and of its subscales, further validation on a larger sample was required.

Patient selection

We studied patients diagnosed with MS according to the revised McDonald’s criteria (8) and consecutively seen for routine checkups outside relapse in 13 different Italian MS centres between 1st September and 1st December 2008.

Data collection

For all the patients, we collected demographic and clinical data, and performed a standard neurological examination, quantified using Kurtzke's Expanded Disability Status Scale (EDSS) (9). At the time of the examination all the patients were asked whether they had swallowing problems after which, irrespective of their response, they were administered the DYMUS questionnaire by a trained physician.

Statistical analysis

Two independent statisticians (RC,MC) analysed the data and performed the validation process, in the following three standard phases: i) determination of the number of existing dimensions and interpretation and labelling of each factor (dimension); ii) questionnaire reliability assessment; iii) construction of a score.

The study of dimensionality. This phase was based on factor analysis using the principal component analysis (PCA) method. The eigenvalues of covariance matrix was used to determine the factors to be extracted. In the Cattel scree plot (10) the eigenvalues themselves lie on the ordinate axis and the eigenvalue numbers on the abscissa axis. If there is unidimensionality, the first eigenvalue assumes a very high value with respect to the others, which are well fitted by a single straight line. The number of dimensions is assumed to be equal to the number of eigenvalues greater than one. If the proportion of variability explained by the first dimension is greater than 50%, the questionnaire is unidimensional.

The reliability assessment. To evaluate the reliability of the questionnaire we computed the Cronbach’s alpha (11), which is a reliability coefficient based on internal consistency. A high Cronbach’s alpha indicates high homogeneity of items; 0.70 is the threshold over which the questionnaire can be considered reliable. In order to evaluate item homogeneity we also computed the inter-item correlation matrix, corrected item-total correlations and computed the “Cronbach’s alpha if item is deleted” values.

Score construction. At the end of the validation process, a global score was calculated. This corresponded to the number of positive responses to questionnaire items.

Results

 Patients

The participation rate was 97%. A total of 1734 patients were recruited: 1202 women (69%) and 532 men (31%). 1232 patients had a relapsing-remitting form of MS (71%), 386 a secondary progressive form (22%), and 116 a primary progressive form (7%). The mean age of the participants was 43.4 years (range: 12-78 years), their mean disease duration was 11.9 years (range: 1-52 years), and their mean EDSS score was 3.3 (range: 0-9.0). At the time of the interview, 527 patients (30%) claimed to have swallowing problems.

Validation of the questionnaire

Study of dimensionality. We ran a factor analysis using the PCA method. The unidimensionality of the DYMUS questionnaire was demonstrated by the finding that the first component explained more than 50% of the total variability (56.92%), and that only the first eigenvalue was over one. In the previous pilot study (7), we identified two subscales for the DYMUS questionnaire, ‘dysphagia for solids’ and ‘dysphagia for liquids’. Therefore, in spite of the questionnaire’s unidimensionality, we also ran a two-component factor analysis. The varimax rotated matrix helped us to identify the items belonging to each dimension. As in the pilot study, the components of the first dimension were all items related to dysphagia for solids (items 1, 3, 4, 5, 7, 8, 10), whereas the components of the second dimension were all items related to dysphagia for liquids (items 2, 6, 9). In order to test the unidimensionality of the ‘dysphagia for solids’ and ‘dysphagia for liquids’ subscales, we again ran a factor analysis. The first component of each subscale was found to explain 60% and 78% of the total variability, respectively, and in both cases only the first eigenvalue was over one. Furthermore, the graphic representation of the eigenvalues suggested the presence of a single latent dimension (Fig.s 1 and 2). Therefore, we can confirm that the subscales are unidimensional.
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Reliability of DYMUS. The 10-item DYMUS questionnaire showed very good internal consistency: Cronbach’s alpha was 0.914. The two subscales were also found to be reliable. The Cronbach’s alpha of the 7-item ‘dysphagia for solids’ questionnaire was 0.885, while that of the 3-item ‘dysphagia for liquids’ questionnaire was 0.864.

Table 1 shows the percentages of positive responses to the single questions, the corrected item-total correlations and the “Cronbach’s alpha if item is deleted” values. The food sticking and weight loss items showed the lowest frequency of positive responses (under 10%). The item weight loss had also the lowest corrected item-total correlation coefficient. However, since the Cronbach’s alpha was found to increase only minimally if this item is deleted, weight loss was retained in the questionnaire.

Score construction. Administration of DYMUS showed that 541/1734 patients (31%) recorded at least one abnormal response. The mean DYMUS score was 1.31 (SD 2.49, range 0-10). The 527 patients who claimed to have swallowing problems had a significantly higher mean DYMUS score than the other 1207 patients (4.19±3.24 vs 0.30±0.97; Mann-Whitney test, p<0.001).

Discussion

The identification of dysphagia at an early stage of MS can make it possible to implement preventive measures, and thus to reduce the risk of complications. However, no specific validated questionnaire for the assessment of dysphagia in MS is currently available. The need for validated scales, in order to improve understanding and reporting of clinical disability in large cohorts, is an issue whose importance has also been underlined by others (12).

We set out to validate an ad hoc questionnaire, DYMUS, that we had previously submitted to a preliminary analysis in a relatively small sample (7). In the present study, in which the instrument was tested on a larger population (1724 MS patients), the considerable ease of use and reliability of the DYMUS questionnaire were confirmed. Given that Cronbach’s alpha, a widely used measure of reliability, is considered good when values are above 0.70, the value of 0.91 obtained by the DYMUS questionnaire emerges as an excellent result. Moreover, since

Table 1 - DYMUS questionnaire administered to 1734 MS patients: percentages of positive responses to the single questions, corresponding corrected item-total correlations and “Cronbach’s alpha if item is deleted” values.

<table>
<thead>
<tr>
<th>Item</th>
<th>Frequency of positive responses</th>
<th>Corrected item-total correlation</th>
<th>Cronbach’s alpha if item is deleted</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Difficulty swallowing solid food</td>
<td>13.5%</td>
<td>.752</td>
<td>.901</td>
</tr>
<tr>
<td>2. Difficulty swallowing liquids</td>
<td>18.9%</td>
<td>.704</td>
<td>.904</td>
</tr>
<tr>
<td>3. Globus sensation</td>
<td>13.7%</td>
<td>.715</td>
<td>.903</td>
</tr>
<tr>
<td>4. Food sticking</td>
<td>5.0%</td>
<td>.536</td>
<td>.913</td>
</tr>
<tr>
<td>5. Coughing after ingestion of solid food</td>
<td>11.7%</td>
<td>.738</td>
<td>.902</td>
</tr>
<tr>
<td>6. Coughing after ingestion of liquids</td>
<td>16.1%</td>
<td>.677</td>
<td>.906</td>
</tr>
<tr>
<td>7. Needs several swallowing actions to swallow solids</td>
<td>11.5%</td>
<td>.756</td>
<td>.901</td>
</tr>
<tr>
<td>8. Cuts food into small pieces in order to swallow it</td>
<td>14.1%</td>
<td>.764</td>
<td>.900</td>
</tr>
<tr>
<td>9. Takes many sips in order to drink</td>
<td>16.4%</td>
<td>.742</td>
<td>.901</td>
</tr>
<tr>
<td>10. Weight loss</td>
<td>8.3%</td>
<td>.457</td>
<td>.916</td>
</tr>
</tbody>
</table>

Functional Neurology 2009; 24(3): 159-162
the principal bias when using Cronbach’s index is that alpha increases with increases in the number of items, to obtain an alpha of over 0.86 with subscales made up of just seven and three items is an outstanding result. The two subscales allowed us reliably to assess two different aspects of the dysphagia, i.e. dysphagia for solids and dysphagia for liquids.

In our opinion, it would be very worthwhile to verify the consistency of DYMUS also in patients with mild clinical pictures (mean EDSS 3.3) as the identification of dysphagia for preventive purposes is more useful in patients with initial dysfunction than in severely impaired patients, in whom preventive interventions may no longer be effective.

In conclusion, this study confirms DYMUS as an easy and consistent questionnaire for detecting dysphagia and its main aspects in MS patients. We propose DYMUS as a practical tool for the preliminary selection of patients to submit to more specific instrumental analyses and of suitable candidates for aspiration prevention programmes.

References


Appendix

Ten-item questionnaire for assessment of dysphagia in multiple sclerosis (DYMUS). The questionnaire can be divided into two subscales: for the assessment of dysphagia for solids (7 items, in bold), and for the assessment of dysphagia for liquids (3 items, in italics).

Instructions for the patient: This questionnaire is about your ability to swallow. Each question refers to your present state, with the exception of the last item, which refers to the past six months. Please answer Yes or No to each question.

ENGLISH

1. Do you have difficulty swallowing solid food (such as meat, bread and the like)?
2. Do you have difficulty swallowing liquids (such as water, milk and the like)?
3. Do you have a globus sensation (the feeling of a lump) in your throat when swallowing?
4. Does food stick in your throat?
5. Do you cough or have a choking sensation after ingesting solid food?
6. Do you cough or have a choking sensation after ingesting liquids?
7. Do you need to swallow several times before solid food “goes down” completely?
8. Do you need to cut food into small pieces to be able to swallow it?
9. Do you need to take many sips in order to drink?
10. Have you lost weight?

ITALIAN

1. Ha difficoltà nel deglutire i cibi solidi (come ad esempio la carne e il pane)?
2. Ha difficoltà nel deglutire i liquidi (come ad esempio l’acqua e il latte)?
3. Ha una sensazione di globo in gola durante la deglutizione?
4. Ha la sensazione che il cibo si fermi in gola?
5. Le capita di tosseire o di avere la sensazione di soffocare mentre ingerisce i cibi solidi?
6. Le capita di tosseire o di avere la sensazione di soffocare mentre ingerisce i liquidi?
7. Ha la necessità di deglutire più volte prima di inghiottire completamente i cibi solidi?
8. Ha la necessità di tagliare il cibo in piccoli pezzi prima di deglutirlo?
9. Ha la necessità di fare più sorsi per bere?
10. Ha perso peso?