

Diagnosis in Muscle Tension Dysphagia

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A – Study Design
B – Data Collection
C – Statistical Analysis
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E – Literature Search
F – Funds Collection

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ABSTRACT:

Introduction: Patient-reported outcome measures have been used within the otorhinolaryngologic disorders' field for many years to compare patient's perception of the severity of symptoms and the effectiveness of a therapeutic approach. Questionnaires that evaluate dysphagia are relatively complex instruments aimed mostly at patients with neurological or malignant diseases. The ICD-10 classification specifies only one broad term – dysphagia (R13). Introduction of Muscle Tension Dysphagia (MTDg) in 2016 by Kang completed the spectrum of the nomenclature. This dysphagia type is defined as a type of laryngeal muscle tension disorder manifesting primarily as swallowing difficulty with or without any accompanying organic cause, laryngeal hyperresponsiveness and/or nonspecific laryngeal inflammation.

Aim: Since there were no clear diagnostic and therapeutic perspectives on the group of patients with MTDg, the aim of this work was to analyse selected diagnostic tools used for the evaluation of swallowing disorders in the context of finding the most suitable tools for patients with Muscle Tension Dysphagia.

Material and method: The material of the work included 61 patients. Each patient underwent otolaryngologic, phoniatic and speech therapist's examination, Functional Endoscopic Evaluation of Swallowing (FEES) and filled out questionnaires concerning dysphonia and dysphagia symptoms.

Results: The results of the work showed that patients with MTDg were characterised by correct results of FEES examination, prolonged swallowing, features of inappropriate mucous and oropharyngeal muscle function.

Conclusions: The Swallowing Disorder Scale (SDS), developed by the authors, correlated best with the cause of dysphagia. The questionnaire corresponded well with the degree of severity. In the diagnostic process of MTDg one of the key tasks is the differentiation with patients with non-normative swallowing patterns. Apart from specialistic consultations with otolaryngologist and speech therapist, while diagnosing MTDg we recommend using objective (FEES, videofluoroscopy, SEMG) and subjective (SDS, DHI, EAT-10 surveys) assessment tools. In our opinion, the inclusion of questionnaires to detect reflux syndromes is also important in the causal treatment of ailments.

KEYWORDS: dysphagia, Muscle Tension Dysphagia, swallowing

ABBREVIATIONS

BMI – Body Mass Index
DHI – Dysphagia Handicap Index
DSRS – Dysphagia Severity Rating Scale
EAT-10 – Eating Assessment Tool
FEES – Functional Endoscopic Evaluation of Swallowing
MST – Malnutrition Screening Tool
MTGg – Muscle Tension Dysphagia
PAS – Penetration-Aspiration Scale
RFS – Reflux Finding Score
RSI – Reflux Symptom Index
SDS – Swallowing Disorder Scale
SEMG – Superficial Electromyography
SWAL-QOL – Swallowing Quality of Life
VHI – Voice Handicap Index

INTRODUCTION

Patient-reported outcome measures have been used within the communication disorders' field for many years to compare patient's perception of change in voice, hearing and tinnitus [1–3]. The basic tool in the screening diagnostics of swallowing disorders is the EAT-10 (Eating Assessment Tool) questionnaire [4]. It was developed on a heterogeneous group of patients both in terms of etiology and the location of dysphagia [5].

According to the literature there are numerous self-administered questionnaires to monitor both the severity of dysphagia and the effectiveness of a therapeutic approach [6]. Nevertheless, their focus is on the evaluation of swallowing-related quality of life rather than swallowing as a specific function [7]. According to Orlando only two questionnaires: DHI (Dysphagia Handicap Index) and SWAL-QOL (Swallowing Quality of Life) were correctly validated [6]. The SWAL-QOL is composed of 44 questions and focuses on dysphagia in the general population and includes general

Tab. I. Swallowing Disorder Scale.

I eat too fast	Yes	Sometimes	No
I am afraid that I will choke during eating	Yes	Sometimes	No
I feel an obstacle in my throat regardless of food intake	Yes	Sometimes	No
I have a problem with chewing food	Yes	Sometimes	No
I have changed the way I swallow to make it easier to eat	Yes	Sometimes	No
I need to swallow again or drink fluids before food will go down	Yes	Sometimes	No
I feel discomfort during eating	Yes	Sometimes	No
I cough up after I eat solid food	Yes	Sometimes	No
I cough up after I drink liquids	Yes	Sometimes	No
I have lost more than 5 kg because of my swallowing problem	Yes	Hard to say	No

health indicators such as fatigue and sleep patterns. The second questionnaire mentioned by Orlandoni – DHI consists of 25 questions divided into three parts regarding physical, emotional and functional issues [8]. The DHI has general application to a wide variety of individuals with swallowing disorders, may be used with individuals with lower literacy levels, and can be used in clinical and research settings alike.

Another type of questionnaires evaluates dysphagia in specific groups of patients [9–11]. These tools are relatively complex instruments aimed mostly at patients with significant swallowing problems with neurological or malignant diseases in the neck region. It is a natural cause of events, since neurological disorders are responsible for oropharyngeal dysphagia in nearly 60% of individuals [12]. The need for new diagnostic tools for dysphagia in specific health conditions is caused by the necessity to facilitate the diagnosis and adapt the therapeutic process [13].

Over the past few years, attention has been paid to a group of patients with abnormal swallowing symptomatology but normal swallowing study results [14, 15]. In 2015 Jalil defined subjective dysphagia as a sensation of a delay in transit of a liquid or solid bolus during the oropharyngeal and/or esophageal stages of swallowing [16]. In 2016 Kang introduced the term Muscle Tension Dysphagia (MTDg) [17]. She defined it as a type of laryngeal muscle tension disorder manifested by swallowing difficulty as the primary complaint. Kang distinguished two types of MTDg. Primary – without any contributing causes, and secondary – with an accompanying organic cause, laryngeal hyperresponsiveness and/or nonspecific laryngeal inflammation. The author started a discussion on the need for new diagnostic and therapeutic perspectives in the group of patients with MTDg.

All procedures performed in the study were in accordance with the ethical standards of the institutional committee and with the 1964 Helsinki declaration. The study was approved by the Institutional Ethics Committee IFPS:/KB/24/2017.

Sponsors did not play any role in the study design; the collection, analysis, and interpretation of data; the writing of the report; and the decision to submit the paper for publication. The Institute of Physiology and Pathology of Hearing covered all expenses incurred during the study.

AIM

The aim of this work was the analysis of selected diagnostic tools used for the evaluation of swallowing disorders in the context of finding the most suitable tools for patients with Muscle Tension Dysphagia.

MATERIAL AND METHOD

The material of the work included 61 patients hospitalized in the Audiology and Phoniatrics Clinic in 2018 who reported symptoms of dysphagia.

In the study, each patient underwent otolaryngologic and phoniatric examination. We collected information about medical history, age, Body Mass Index (BMI) and asked patients to fill out the Voice Handicap Index (VHI), Reflux Symptom Index (RSI), EAT-10, Malnutrition Screening Tool (MST), DHI questionnaires and Swallowing Disorder Scale (SDS) developed by the authors (Tab. I.). Creation of the scale was based on authors' clinical experience with patients suffering from dysphagia and literature data including the available questionnaires. The scale consists of 10 questions associated with the oropharyngeal phase of swallowing, grouped in the following way: questions 1–3 concerning subjective sensations that may suggest other throat pathologies apart from dysphagia; questions 4–6 focusing on the dysfunctions of the oropharyngeal phase; questions 7–10 suggesting the occurrence of more serious symptoms of dysphagia such as aspiration. The questions were selected by the authors in the form of a quick screening test indicating the location and possible causes of the disorder. Each question had an accompanying response choice of “no” (a score of zero), “sometimes or hard to say” (a score of 2) or “yes” (a score of 4).

Functional Endoscopic Evaluation of Swallowing (FEES) was carried out using fiberoptic endoscope Olympus Evis Exera III CV 190. Nine attempts of food intake were evaluated. Three with water (10, 15 and 20 mL), three with yogurt (10, 15 and 20 mL) and three with a kaiser roll (3, 6 and 9 grams). The time necessary for effective swallowing and chewing and the number of swallows were measured. The patient was instructed to take in a volume of fluid into his/her mouth and then swallow in as many portions as comfortable. The time was measured only when the total amount

Tab. II. Mean values of age, BMI and scores obtained from the questioners in subsequent patient groups. Spearman correlation coefficient and P-value of dysphagia assessment tools with the 6-degree Dysphagia Severity Rating Scale (DSRS), modified 7-degree Dysphagia Severity Rating Scale (added 1 degree, redefined as non-normative swallowing pattern) and Swallowing Disfunction Scale (SDS) is shown.

	AGE	BMI	VHI	EAT-10	MST	RSI	DHI	SDS
Patients with unilateral laryngeal paralysis N = 20	50 (SD 16)	29.1 (SD 8)	56.8 (SD 20)	7 (SD 7.6)	0.9 (SD 1.4)	18 (SD 7)	18 (SD 18)	6.5 (SD 4.6)
Patients with neurological disorders N = 10	57 (SD 16)	25.4 (SD 3.4)	66.6 (SD 29)	15 (SD 12)	0.6 (SD 1.2)	23 (SD 9.6)	35 (SD 26)	13 (SD 7.8)
Patients without neurological or malignant history N = 31	62 (SD 12)	27.3 (SD 4.5)	41 (SD 33)	11 (SD 9)	0.7 (SD 1.2)	23 (SD 11)	28 (SD 24)	14 (SD 9.2)
Correlation with 6-degree DSRS				0.42	0.24	0.12	0.37	0.4
P-value				P < 0.01	P > 0.05	P > 0.05	P < 0.01	P < 0.05
Correlation with 7-degree DSRS				0.48	0.28	0.22	0.45	0.45
P-value				P < 0.01	P > 0.05	P > 0.05	P < 0.01	P < 0.01
Correlation with SDS				0.55	0.08	0.31	0.58	
P-value				P < 0.01	P > 0.05	P > 0.05	P < 0.01	

of the substance was found in the oral cavity. Episodes of retention, penetration and aspiration were pointed out. Patients were evaluated with the Reflux Finding Score (RFS) and the Penetration-Aspiration Scale (PAS). The algorithm of dysphagia diagnostics in our clinic assumes parallel superficial electromyography (SEMG) during FEES. We use Neurosoft 4 channel EMG device to examine symmetrical muscles (masseter, submental, infrahyoid, trapezius) simultaneously on the left and the right side.

Speech therapist assessed the anatomical structure and efficiency of the oral organs: language (including palpation of the sublingual frenulum, coordination of language movements – retraction and lateral movements necessary for oral processing and transport of bite and possible retention in the oral cavity or vestibule of the mouth); hard and soft palate; masseter, cheeks, and submental muscle activity; lips and possible abnormalities in their closing; jaw mobility; dentition and temporo-mandibular joints [18, 19]. The therapist evaluated the oral phase of swallowing to recognize the potential pathomechanisms, the way of chewing, forming and transporting of food, as well as the coordination of the oral and pharyngeal phase, which in some cases manifested as occurrence of clearing up, prolonged chewing and difficulties in initiating the act of swallowing. An interview for taste and smell disturbances was conducted [20]. In some cases, a study of oral stereognosis was carried out using logopaedic spatulas. The assessment of the swallowing function was supplemented with information on how the patient is fed at the time of the study. In selected cases, a retrospective analysis of various primary activities was carried out with emphasis on the development of these skills. An interview was conducted in terms of existing motor parafunctions of the masticatory system.

Based on the results of the above-mentioned examinations, patients were classified according to the Dysphagia Severity Rating Scale (DSRS) [21]. The scale includes 6 degrees of dysphagia, from

minimal (minimal swallowing disorder, with possible discomfort, change of diet is not necessary) to severe (more than 10% of aspirations in all kinds of food, cessation of oral nutrition is advised).

For statistical analysis of parameters obtained in the work, the following tests were used: Pearson and Spearman correlation and Mann-Whitney test. The level of statistical significance was set at $P < 0.05$.

RESULTS

The group included 24 males and 37 females at the mean age of 56 years (standard deviation SD – 16 years). Authors subdivided patients according to factors of medical history directly influencing swallowing. Twenty patients had unilateral paralysis of the larynx after surgeries of the neck region (group 1), 10 patients suffered from neurological disorders (group 2), 31 reported problems with swallowing, but had none of the above health conditions nor a history of malignancy (group 3). In the study all subjects presented abnormalities in the structure and efficiency of the articulatory organs and in the assessment of primary functions. Limited mobility of the tongue was also observed as a result of incorrect structure of the sublingual frenulum, as well as malocclusion, missing teeth (premolars and molars) and incorrectly fixed lower dentures. In more than half of the patients, dysfunctions of the temporo-mandibular joint were reported on – dislocations of the joint discs without blockage, slipping and acoustic symptoms – crackling while mandible movement. In the group of patients with incorrect primary functions, most cases had an anatomic cause – ankyloglossia, dental defects and malocclusion.

According to the logopaedic examination, most patients manifested a non-normative pattern of the first phase of swallowing. Atypical swallowing resulted from abnormal motility of the tongue,

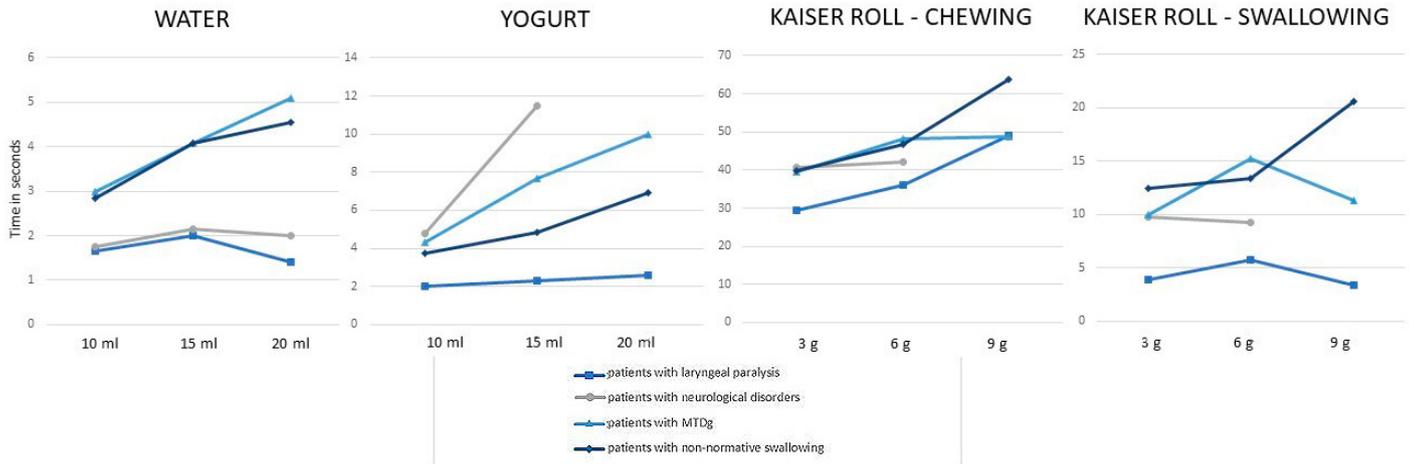


Fig. 1. Swallowing time.

lips, malocclusion, non-physiological breathing pattern or other parafunctions within the masticatory apparatus. In the logopaedic nomenclature the non-normative swallowing pattern defines a situation when the tongue assumes a different than vertical and horizontal position at the time of swallowing, but there is no greater risk of aspiration of the digestive contents than in the healthy population [22, 23]. This term is not associated with dysphagia.

Tab. II. shows the results of questionnaires in the 3 groups of patients. To be able to distinguish patients with MTDg and a solely non-normative swallowing pattern, which are new terms not clearly included in the severity rating scales, we added the 7th degree in DSRS. A new rank was given to patients with a non-normative swallowing pattern. It lay between normal swallowing and minimal dysphagia. Patients who met the criteria of muscle tension dysphagia were classified according to dysphagia severity. The results shown in Tab. II. illustrate that the emergence of the additional rank reinforced the correlations with swallowing evaluation surveys.

The highest values obtained from the questionnaires were reported by patients with neurological disorders (group 2). Patients from the 3rd group assessed their complaints as nearly as bad as the 2nd group. Only VHI results were the lowest for the 3rd group in comparison with the another two. Correlation of the surveys concerning swallowing dysfunction complaints with the severity of dysphagia showed that EAT-10, DHI and SDS had the highest correlation ratios. SDS had the highest correlation with dysphagia cause (the ratio was 0.31 and 0.44 for questions 1–3). The coefficients rose when an additional degree in the Dysphagia Severity Rating Scale was established, describing a subgroup of patients with a non-normative swallowing pattern. Tab. III. shows the results of SDS including the division into groups of questions. Group 3 was divided according to the swallowing dysfunction cause – MTDg or non-normative swallowing pattern. The group-differentiating criterion was the result of the FEES study and the duration of swallow. We have adopted the results developed by Vaiman, as normative values [24]. The author observed that the duration of one swallow of water lasted 1–5.74 s and the duration of 20cc swallow lasted 1.8–6.2 s for patients aged 18–70 years.

Tab. III. Results of SDS including the division into groups of questions. Questions 1–3 concern issues related to subjective sensations that may suggest other throat pathologies apart from dysphagia, questions 4–6 focused on the oropharyngeal phase; questions 7–10 suggest the occurrence of more serious symptoms of dysphagia such as aspiration.

	QUESTIONS 1–3	QUESTIONS 4–6	QUESTIONS 7–10	TOTAL
Patients with unilateral laryngeal paralysis	2.7 (SD 1.8)	1.4 (SD 2.5)	2.4 (SD 2.5)	6.5 (SD 4.6)
Patients with neurological disorders	3.2 (SD 2)	4.8 (SD 3.4)	5.2 (SD 4.1)	13 (SD 7.8)
Patients with MTDg N = 17	5.5 (SD 2.7)	4.1 (SD 3.6)	4.1 (SD 4.6)	14 (SD 9.6)
Patients with non-normative swallowing pattern	5.4 (SD 2.9)	4 (SD 3.5)	4.3 (SD 3.9)	14 (SD 8.6)
Correlation with 7-degree DSRS	0.07	0.51	0.38	0.45
P-value	P > 0.05	P < 0.01	P < 0.01	P < 0.01

Patients aged more than 70 years had a longer duration of swallow, respectively 2.3–6.7 and 1.8–8.13 seconds. Fig. 1. shows the duration of food swallowing and chewing in different subgroups of patients. This figure demonstrates a disproportionate to the severity of dysphagia increase of duration of swallowing in patients with MTDg and a non-normative swallowing pattern. Results of patients with unilateral laryngeal paralysis were lower than the results of other groups for each type of food. We did not show the results of patients with neurological disorders which included swallowing of 20 mL of yogurt and 9 g of kaiser roll because more than half of the patients had problems with swallowing of smaller amounts of those products and for the safety of those patients we decided not to give them those amounts of food.

The SDS and DHI questionnaires correlated strongly – the ratio was 0.58 (Spearman correlation) and 0.61 (Pearson correlation). As shown in Tab. III., questions 4–6 and the total score correlated best with the dysphagia severity.

DISCUSSION

The role of diagnostics in patients with swallowing disorders assumes not only the diagnosis of dysphagia, but also the specification of the severity of dysphagia, and thus the determination of a further therapeutic program. ICD-10 classification gives only one broad term – dysphagia (R13). In our opinion this recognition should always be expanded to provide other specialists involved in the therapeutic process with clear data. The introduction of the term Muscle Tension Dysphagia by Kang completed the spectrum of the nomenclature. The subgroup is particularly important in everyday practice of otolaryngologic and phoniatic departments. As stated by Kang and co-authors, patients with MTDg report a significant impact of their dysphagia on the quality of life and increased medical expenditures due to repeated specialist evaluations with no diagnosis or treatment offered [17]. A large percentage of patients diagnosed with MTDg in our work is caused by the characteristics of our department. Patients admitted to our clinic reported problems with swallowing as a basic complaint.

In the logopaedic nomenclature there is a clear distinction between dysfunction of swallowing and swallowing disorder – interchangeably translated as dysphagia. Dysfunction of swallowing is also recognized as a non-normative swallowing pattern and is due to an improper position of the tongue [22, 23]. Poor resting position of the tongue and the resulting difficulties in bolus processing and sucking the tongue into the palate result in fragmentary swallowing that is not described in dysphagia with multiple swelling [25]. Despite the discomfort experienced by the patient, there is no risk of aspiration. Poor resting position of the tongue usually generates defects in articulation and malocclusion in this group of patients. By affecting the tension of the oral cavity, the peripheral areas directly affect muscle tone, the position of the hyoid bone, mandible, head protraction and consequently functional dystonia. Therefore, the occurrence of voice disorders in this group of patients may be frequent, as we have seen in our study group.

Kang treats MTDg as a type of laryngeal muscle tension disorder. Vaiman in turn mentions swallowing disorders which may result in dysphagia. In our opinion MTDg is a broader concept that can cover not only laryngeal but also oral and pharyngeal muscle tension disorders. Separation of patients with non-normative swallowing pattern increased the correlation ratio with symptom severity. The results of the research showed that EAT-10, DHI and SDS scales have moderate correlation strength with the severity of dysphagia symptoms. Different characteristics of patients with non-normative swallowing pattern and MTDg was particularly visible in the results of SDS. Those patients were characterized by a higher sum of question 1–3 in relation to other groups. The observation suggests a higher emotional component in these patients. The inclusion of questions related to subjective feelings resulted in a decrease in correlation with the degree of dysphagia severity, but in our opinion it might guide the physician to the most likely cause of the disorder.

MTDg is a kind of objective dysphagia in accordance with Jalil definition, since an objective delay of bolus transit has been observed in those patients [16]. Our observations show that another factor contributing to the development of functional disturbances of swallowing is the disturbance of the sensory function of the mucosa. Farneti states that insufficient sensory control from the subglottic receptors is one of the main reasons of prolonged muscular contraction [26]. As the author explains the precise coordination of the respiratory and digestive system is crucial in safe swallowing and this is reflected by the close topographic organisation of respiratory, deglutitory and branchial motor neurons. As a result of the neuroanatomical connection of motor neurons for the pharynx and larynx, the feedback from subglottic receptors may affect the recruitment of pharyngeal motor neurons during swallowing. This may result in the lengthening of the duration of swallowing. Abnormal sensory irritation of the mucosa in our opinion also contributed to other complaints reported by patients: dryness and a feeling of discomfort in the throat. Vaiman states that normal swallowing is a reflex action, the duration should not vary depending on the consistency of the food. He observed that age above 70 years had an influence on elongation in the group of healthy adults [24]. The prolongation was also observed as the amount of food increased. Authors observed smaller differences between the duration of swallowing of normal and excessive volume (20 cc) in adults 70+. They suggested that elderly people adapt to larger bolus volumes by increasing muscle tension instead of prolonging muscle contraction.

The patient profile makes MTDg one of the most common pathologies associated with swallowing disorders found in our clinic. This resulted in the need to search and then adapt the diagnostic tools to this group of patients. The questionnaire developed by the clinic team is characterized by the highest correlation with the cause of dysphagia. Apart from specialistic consultations with an otolaryngologist and speech therapist, while diagnosing MTDg we recommend using objective (FEES, videofluoroscopy, SEMG) and subjective (SDS, DHI, EAT-10 surveys) assessment tools. In our opinion, the inclusion of questionnaires to detect reflux syndromes is also important in the causal treatment of ailments. Just as it has been observed by Kang in patients with MTDg, reflux symptoms are common, requiring further gastrological diagnosis.

CONCLUSIONS

Analysed results of patients with MTDg show that this group is characterised by correct results of FEES examination, prolonged swallowing, and features of inappropriate mucous and oropharyngeal muscle function. The SDS questionnaire developed by the authors correlated best with the subgroups of dysphagia types. The questionnaire corresponded well with the degree of severity. In the diagnostic process of MTDg dysphagia one of the key tasks is the differentiation with patients with non-normative swallowing patterns.

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