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Demographic characteristics and spectrum of comorbidities in patients with muscle tension dysphonia: a retrospective cross-sectional study

Demografske karakteristike i spektar komorbiditeta kod osoba sa mišićnom tenzionom disfonijom: retrospektivna studija preseka

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Abstract

Background/Aim. Muscle tension dysphonia (MTD) is one of the most common voice disorders. The aim of the study was to examine demographic characteristics and the prevalence of comorbidities in patients diagnosed with MTD. **Methods.** A retrospective cross-sectional study included an analysis of demographic characteristics and comorbidities in 87 patients diagnosed with MTD during a one-year period. **Results.** The mean age of the patients was 49.2 years (range 18–84 years), and 79.3% were younger than 65 years. The female gender comprised 73.6%. No statistically significant difference was found in smoking status between men and women ($\chi^2 = 0.624$; $p > 0.05$). Out of the 87 patients, 43 (49.4%) were professional voice users. Among these patients, 20 (46.5%) were school teachers, 8 (18.6%) sales-related occupations, 5 (11.6%) professional singers, 3 (7.0%) kindergarten teachers, 3 (7.0%) lecturers, 2 (4.6%) psychologists, 1 (2.3%) speech-language pathologist, and 1 (2.3%) fitness instructor. Secondary MTD was diagnosed in 36 (41.4%) patients. The most common clinical findings diagnosed in those with secondary MTD were vocal cord nodules in 24 patients (66.7%). The prevalence of comorbidities were as follows: mild to moderate hearing loss (9.2%), postnasal drip (31.0%), hypersensitivity to common inhalant allergens (31.0%), asthma or chronic obstructive pulmonary disease (18.4%), thyroid dysfunction (17.2%), and history of gastroesophageal reflux disease (21.8%). **Conclusion.** MTD is more frequent in females and professional voice users. Due to the high prevalence of comorbidities in MTD patients, a detailed history and additional examinations are necessary in order to determine the final treatment plan.

Key words:
comorbidity; demography; dysphonia; prevalence; serbia.

Apstrakt

Uvod/Cilj. Mišićna tenziona disfonija (MTD) je jedan od najčešćih poremećaja glasa. Cilj rada bio je da se ispitaju demografske karakteristike i prevalencija komorbiditeta kod pacijenata kojima je postavljena dijagnoza MTD. **Metode.** Retrospektivnom studijom preseka analizirane su demografske karakteristike i komorbiditeti kod 87 pacijenata kojima je postavljena dijagnoza tokom jednogodišnjeg perioda. **Rezultati.** Prosečna starost pacijenata bila je 49,2 godine (opseg 18–84 godina), a 79,3% je bilo mlađe od 65 godina. Ženski pol činio je 73,6%. Nije utvđena statistički značajna razlika u pušačkom statusu između muškaraca i žena ($\chi^2 = 0{,}624$; $p > 0{,}05$). Od 87 pacijenata, 43 (49,4%) su bile osobe koje se bave profesijama koje zahtevaju intenzivnu upotrebu glasa. Među ovim pacijentima, 20 (46,5%) su bili nastavnici u školi, 8 (18,6%) prodavci, 5 (11,6%) profesionalni pevači, 3 (7,0%) vaspitači u vrtiću, 3 (7,0%) predavači, 2 (4,6%) psiholozi, 1 (2,3%) logoped i 1 (2,3%) *fitness* instruktor. Sekundarna MTD dijagnostikovana je kod 36 (41,4%) pacijenata. Najčešći klinički nalazi dijagnostikovani kod osoba sa sekundarnom MTD bili su čvorići na glasnim žicama kod 24 pacijenta (66,7%). Prevalencija komorbiditeta bila je sledeća: blago do umereno oštećenje sluha (9,2%), postnazalna sekrecija (31,0%), preosetljivost na uobičajene inhalatorne alergene (31,0%),

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astma ili hronična opstruktivna bolest pluća (18,4%), poremećaj rada štitaste žlezde (17,2%) i anamnestički podaci o gastroezofagealnoj refluksnoj bolesti (21,8%). **Zaključak.** MTD se češće javlja kod žena i osoba koje se bave profesijama koje zahtevaju intenzivnu upotrebu glasa. Zbog visoke prevalencije komorbiditeta kod pacijenata kojima je postavljena dijagnoza MTD, neophodni su detaljna anamneza i dodatna ispitivanja kako bi se odredio konačan plan lečenja.

Ključne reči:
komorbiditet; demografija; glas, poremećaji; prevalenca; srbija.

Introduction

Muscle tension dysphonia (MTD) refers to an excessive tension of extrinsic and intrinsic laryngeal muscles, which can be identified by surface electromyography and leads to voice change, throat pain, and vocal fatigue [1]. It represents one of the most frequent voice disorders, with an estimated prevalence of up to 40% of presenting disorders in voice clinics [2, 3]. MTD can be categorized as primary or secondary depending on whether the underlying organic conditions are present (secondary) or absent (primary). Diagnosis is done with a case history, an inspection of the hard glottal attack and any elevation of the larynx, palpation of the strap muscles to identify any increased tension, and stroboscopy [4, 5]. As previously mentioned in the definition of the condition, surface electromyography is a valuable diagnostic modality, but it is not routinely available in clinical practice. Although surgery is often necessary in secondary MTD, the cornerstone of therapy is conservative treatment. Voice therapy is fundamental, and MTD is one of the most common reasons for a voice therapy referral [6].

MTD is thought to be a compensatory manifestation of an underlying disturbance in laryngeal structure and/or function [1]. In our opinion, establishing all the contributing factors in the pathophysiology of MTD will result in the proper choice of therapeutic approach.

The aim of this study was to examine demographic characteristics and the prevalence of comorbidities in patients with MTD, as the recognition of all of the underlying etiologic factors may be crucial to determining the adequate treatment modality.

Methods

The study was performed in accordance with the International Code of Medical Ethics of the World Medical Association, Declaration of Helsinki (1964). It was a part of the regular assessment and treatment of patients at the Phoniatric Department of the Clinic for Otorhinolaryngology and Maxillofacial Surgery, Faculty of Medicine of the University of Belgrade, Serbia (No. 16-UFO-01).

Our retrospective cross-sectional study included 87 patients diagnosed with MTD during their first visit to the Phoniatric Department. A retrospective chart review of these patients was performed over a period of one year. The MTD diagnosis was clinically determined by the same senior laryngologist who reviewed the detailed case histories and physical examinations.

Our diagnostic algorithm was used to identify comorbidities that could potentially affect laryngeal muscle tension. Clinical examination protocol included: pure tone audiometry, nasendoscopy, and skin prick test for common inhalant allergens. Hearing loss was characterized as > 25 decibels (dB) of hearing thresholds at 0.5, 1, 2, and 4 kilohertz (kHz) in the worse hearing ear. Anamnestic data on demographic characteristics, smoking status, occupational vocal load, thyroid status, gastroesophageal reflux disease (GERD), and pulmonary disease were included in the analysis. According to Koufman and Isaacson [7], patients' vocal load was classified into professional voice users (PVUs), levels I–III, and nonprofessional voice users, level IV. To analyze the influence of age on MTD, patients were divided into those above and below 65 years of age [8].

Exclusion criteria encompassed premalignant and malignant laryngeal lesions, laryngeal papillomatosis, previous radiotherapy in the head and neck region, previous laryngeal surgery, and neurologic and muscle diseases.

Statistical analysis

Data analysis was performed using IBM SPSS Statistics version 22 (SPSS Inc., Chicago, IL, USA) and the R statistical software (R Core Team, 2019). Descriptive statistics were calculated to summarize demographic and clinical characteristics of the study population. For categorical variables, frequencies and percentages were calculated, while continuous variables were reported as means with standard deviations.

To examine associations between categorical variables, Pearson's Chi-square test was employed. For comparisons between continuous variables across different MTD groups, Student's independent *t*-test was used. Spearman's rank correlation coefficient was calculated to assess correlations between comorbidity parameters and MTD status. A *p*-value < 0.05 was considered statistically significant.

Results

The mean age of the patients was 49.2 ± 16.7 years (range 18–84). Females represented 73.6% [64 patients with a mean age of 46.7 ± 15.9 years (range 18–76)] of the cohort. The proportion of patients aged < 65 years [69 (79.3%)] was higher than those aged ≥ 65 years [18 (20.7%)]. In the female group, 8 were smokers and 56 were non-smokers, while in the male group, 2 were smokers and 21 were non-smokers (Table 1). Statistical analysis showed

no difference in smoking status between males and females to the level of statistical significance ($\chi^2 = 0.624$; $p > 0.05$).

Out of the 87 patients, 43 (49.4%) were PVUs. The majority of PVUs were school teachers (20; 46.5%), followed by sales-related occupations (8; 18.6%) (Figure 1).

Out of the 87 patients, 51 (58.6%) had primary MTD, while 36 (41.4%) were diagnosed with secondary MTD. Of the 36 patients with secondary MTD, the majority were females, 31 (86.1% vs. 13.9%). Secondary MTD was statistically more frequent in females than males ($\chi^2 = 4.972$; $p < 0.05$). The mean age of patients with primary MTD and secondary MTD was 54.86 ± 14.7 years and 41.28 ± 16.16 years, respectively. There was a statistically significant difference between the primary and secondary MTD groups ($t = 4.074$; $df = 85$; $p < 0.001$). The most common findings in patients with MTD were vocal fold nodules [24/36 (66.7%)]. Structural findings in secondary MTD are summarized in Figure 2.

Pure tone audiometry showed abnormal pure-tone thresholds in 8 (9.2%) patients with mild to moderate hearing loss. Twenty-seven (31.0%) patients had a postnasal drip on nasoendoscopy. Skin prick test revealed that 27 (31.0%) patients were sensitive to common inhalant allergens. Anamnestic data demonstrated that 16 (18.4%) patients had asthma or chronic obstructive pulmonary disease (COPD). Fifteen (17.2%) patients had thyroid hormone replacement therapy or Hashimoto thyroiditis. Nineteen (21.8%) patients had a history of previously treated GERD. Figure 3 summarizes the total number of comorbidities, considering that some patients had multiple comorbidities.

Using Spearman's rank correlation coefficient, we were unable to find a correlation between the observed comorbidities and primary and secondary MTD. Likewise, there was no statistically significant difference in the frequency of these comorbidities in primary versus secondary MTD.

Table 1

Demographic characteristics of patients with muscle tension dysphonia

Parameters	Female	Male	Total
Patients, years	64 (73.6)	23 (26.4)	87 (100.0)
< 65	55 (85.9)	14 (60.9)	69 (79.3)
≥ 65	9 (14.1)	9 (39.1)	18 (20.7)
Smokers	8 (9.2)	2 (2.3)	10 (11.5)
Non-smokers	56 (64.4)	21 (24.1)	77 (88.5)
Age	46.7 ± 15.9 (18–76)	56.4 ± 17.1 (21–84)	49.2 ± 16.7 (18–84)

Values are given as numbers (percentages) except for the age parameter, which is expressed as mean ± standard deviation (minimum–maximum).

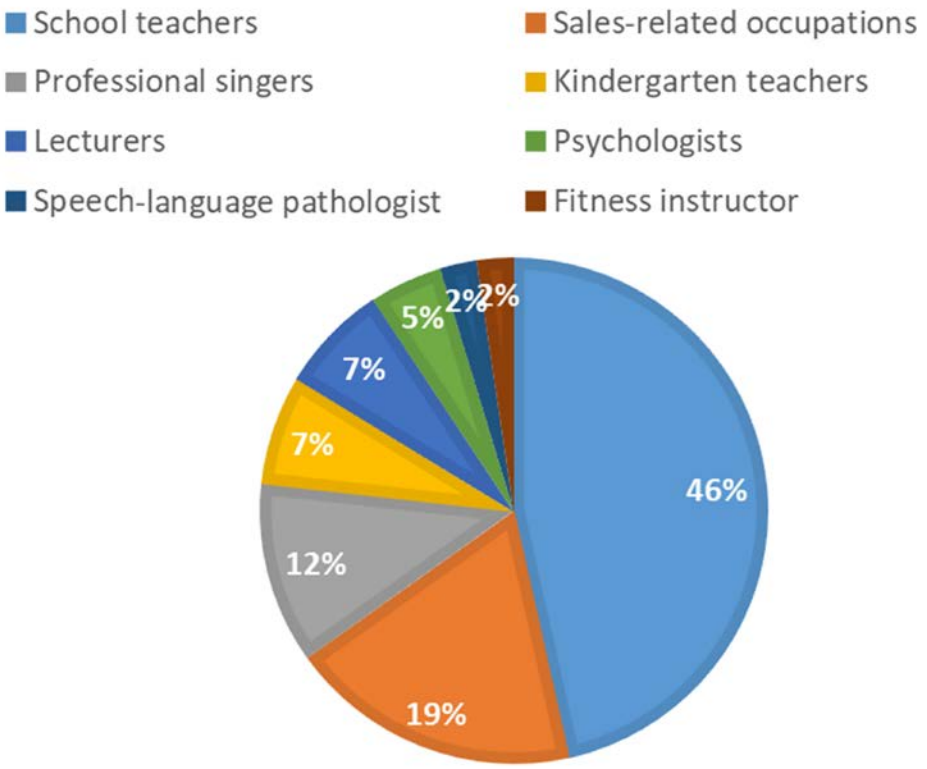

Fig. 1 – Distribution of professions with vocal load (n = 43).

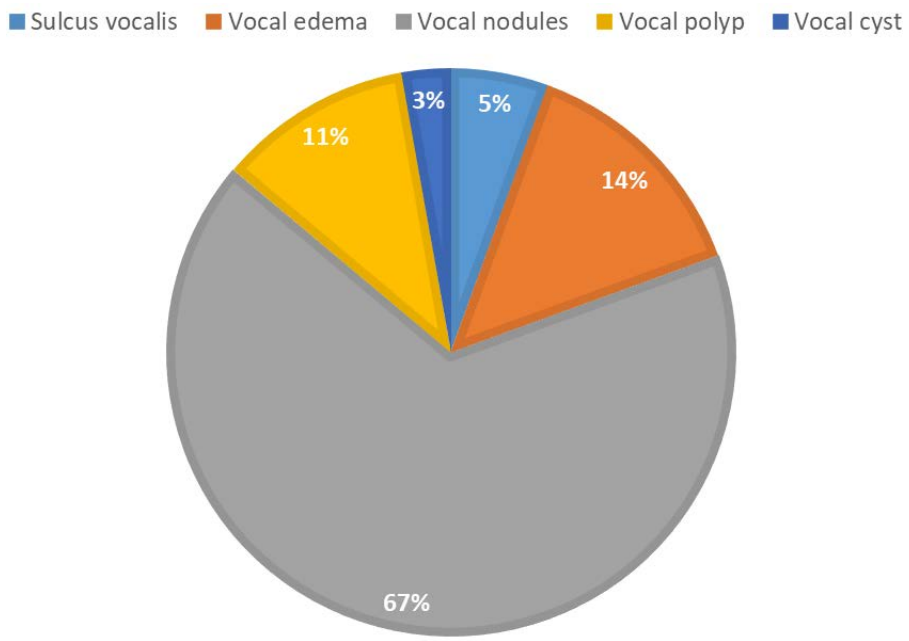

Fig. 2 – Structural changes in secondary muscle tension dysphonia (n = 36).

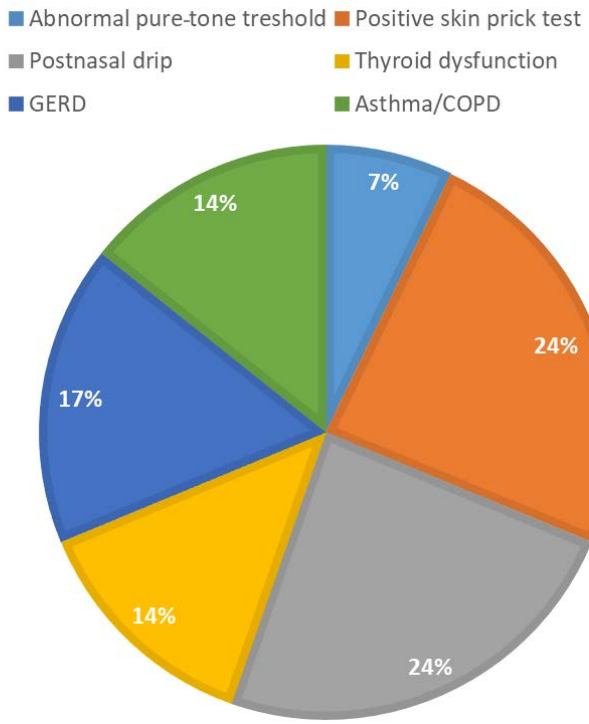

Fig. 3 – Total number of comorbidities in patients with muscle tension dysphonia (n = 87). GERD – gastroesophageal reflux disease; COPD – chronic obstructive pulmonary disease. Note: each particular comorbidity is presented according to the total number of comorbidities, considering that some patients had multiple comorbidities.

Discussion

Identifying the nature of the voice impairment is the fundamental purpose of the voice evaluation. Previous studies suggest that several etiological factors could play a role in patients with MTD, including psychological/personality factors, vocal abuse/misuse, underlying factors such as organic fold lesions, laryngopharyngeal reflux, altered hormonal status, aging of the larynx, and upper respiratory tract infection [1, 9]. Stroboscopic examination reveals posterior glottal chink, supraglottic contraction, and/or anterior-posterior contraction. Stroboscopy is highly important in establishing the diagnosis of MTD by providing a more detailed

examination of the vocal fold vibratory properties and any subtle abnormalities which can be easily missed by mirror laryngoscopy in general otorhinolaryngologists' practice, hence, patients with MTD can be underdiagnosed [6].

Analysis of patients' age data revealed that the majority (79.3%) of patients with MTD are part of the working population under the age of 65. This highlights the impact of MTD on employees' work performance and the significance of the timely initiation of appropriate treatment in order to minimize sick leave.

Voice change is detrimental for all patients, especially for voice professionals, given that dysphonia can be crucial to job performance. Our study findings showed that 49.4% of participants were PVUs, with teachers and sales-related occupations being the most prevalent. As previously reported, PVUs are at a significant risk of developing hyperfunctional voice disorders [9, 10]. Moreover, in PVUs, patient-perception of voice impairment can be influenced by occupational demand, which probably leads to earlier evaluation of voice changes [11]. The high prevalence of PVUs with MTD in our study suggests the necessity of further studies of voice training programs and effective treatment planning in professions with a vocal load.

On the other hand, aging promotes structural and functional changes of laryngeal structures, which can lead to voice change [12]. Belafsky et al. [13] showed that persons with underlying glottal insufficiency in the face of presbylaryngis are 17 times more likely to exhibit abnormal compensatory hyperkinetic laryngeal behaviors. In our study, 20.7% of patients were 65 or older. Voice disorders in the elderly population frequently bring fear of cancer and a negative impact on quality of life, hence, adequate therapy of MTD in the elderly will have a significant impact on their ability to maintain social activities, as well as functional and emotional well-being [14].

According to our results, a relatively small proportion of patients with MTD (11.5%) were smokers. In a large cross-sectional study with 821 adult participants, smoking was not associated with functional voice disorders [15].

The majority (73.6%) of patients with MTD in our study were females, which is consistent with other studies [16]. Female preponderance in MTD encompasses multiple factors including physiologic (lesser amount of hyaluronic acid in the superficial layer of the *lamina propria*; shorter vocal folds with higher frequency vibration) and psychological/personality factors (higher level of stress; higher effort in background noise), which could make them more vulnerable to phonotrauma [3, 6, 17, 18]. Our findings also showed that secondary MTD is more frequent in female patients (86.1% vs. 13.9%). Multiple factors influencing female voice may be related to voice disturbances, and special consideration must be taken when evaluating females for MTD.

Previous studies demonstrate that hearing loss affects voice production [19, 20]. Our analysis revealed that 8 (9.2%) patients with MTD also had audiometrically proven hearing loss. Own-voice perception is a result of hearing ability and can interfere with voice production. It is reasonable to assume that individuals with hearing loss are more likely to compensate with inappropriate vocal techniques, resulting in MTD. Hengen et al. [20] also indicated that hearing aids can affect vocal satisfaction. In our opinion, hearing evaluation in selected cases can reveal a subset of patients who will benefit from hearing aids along with other therapeutic strategies.

In our study, the prevalence of patients with inhalant allergy, postnasal drip, and asthma/COPD was 31.0%, 31.0%, and 18.4%, respectively. According to the 2019 Serbian National Health Survey published by the Statistical Office of the Republic of Serbia, the prevalence of allergies in the general population is 7.3%. The prevalence of asthma and COPD in the Serbian population is 3.6% and 3.5%, respectively [21].

Dysphonia, vocal fatigue, throat clearing, and cough are among the most common complaints in patients with allergic rhinitis, allergy, and asthma, and also in patients taking inhaled steroids [22–25]. It is possible that symptoms like runny nose, itchy eyes, shortness of breath, and cough are more prominent and therefore distract from observing voice changes in these patients. Nonetheless, irritation in the upper airways and gradual voice deterioration might lead to voice disorders and a significantly worsening quality of life.

The lifetime prevalence of allergic rhinitis in the United States is estimated between 11% and 33%, and between 10% and 41% in Europe [26]. The results of one Swedish study showed that patients with confirmed allergic rhinitis from birch pollen experienced voice symptoms during both the pollen and non-pollen season [27]. Given that population-based studies have shown increases in allergic rhinitis prevalence in the adult population in recent decades, it is important to exclude allergies when assessing patients with MTD. Findings of airborne allergies could significantly influence the treatment plan for these patients.

In our study, 15 (17.2%) patients had a history of clinical hypothyroidism with levothyroxine replacement therapy or Hashimoto's thyroiditis with normal thyroid hormone levels but elevated levels of antibodies to thyroglobulin and thyroid peroxidase. Clinical manifestations of hypothyroidism, among others, include voice change, profound fatigue, dry mouth, and lethargy [28]. However, voice change in thyroid disease might be less obvious compared to other, more severe symptoms. According to the published literature, a significant number of patients who reach biochemical treatment targets with thyroid hormone replacement therapy have persistent complaints. There is a subset of patients in which symptoms persist despite the patients' euthyroid status while receiving hormone substitution. Persistent symptoms respond only partly to adequate thyroid hormone substitution and are thought to be related to autoimmune disease rather than to hypothyroidism [29–32]. Furthermore, Carta et al. [33] found a link between the presence of the antithyroid peroxidase autoantibodies and the diagnosis of mood or anxiety disorder, which is independent of gender and age. In our opinion, patients with thyroid dysfunction deserve special attention when evaluated for MTD. Voice symptoms in patients with hormone replacement therapy and/or

antithyroid autoantibodies might be atypical or subtler since not all patients benefit from levothyroxine supplementation. Further investigations might be needed to determine the role of thyroid dysfunction in voice disorders.

Our data showed that 19 (21.8%) patients had a history of GERD without presentation of laryngopharyngeal reflux (LPR) clinical findings. Hoarseness can be one of the extraesophageal symptoms of GERD [34]. One possibility is that increased laryngeal muscle tension and associated voice change might have occurred as a result of previous gastric reflux. The other possible mechanism may include nasal symptoms. A review by Hanna and Wormald [35] concluded that reflex response between the esophagus and nose can produce postnasal drip in patients with GERD. Although not to the level of statistical significance, the authors proved that gastroesophageal reflux leads to nasal congestion and increased mucus secretion. Our data suggest that in MTD patients with a history of GERD, it seems justifiable to include diet and lifestyle changes in the treatment plan to prevent the potential effects of reflux. Considering that LPR often coexists with GERD, patients with MTD and a history of GERD could benefit from further investigations for LPR, including impedance-pH metry, and pepsin and trypsin detections.

In addition, it is worth pointing out that our study is limited by its retrospective nature. Further research is needed to examine the potential benefits of treating comorbidities in patients with MTD.

Conclusion

Muscle tension dysphonia is most commonly diagnosed in females and professional voice users. Voice specialists should consider multiple potential etiologies for altered muscular tension of extrinsic and intrinsic laryngeal muscles. The reported comorbidities in patients with muscle tension dysphonia may influence their response to treatment. The further assessment of how hearing loss, inhalant allergy, postnasal drip, asthma/chronic obstructive pulmonary disease, thyroid dysfunction, and history of gastroesophageal reflux disease interact with muscle tension dysphonia remains to be further studied. Although voice therapy plays an important role in treating patients with muscle tension dysphonia, in treatment planning, it is rational to perform a more detailed history and assessment, revealing all the potential contributing disorders.

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