

Questionnaire of Patients to Assess the Condition of the Voice Forming Apparatus, as One of the Methods for Early Diagnosis of Parkinson's Disease

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Abstract Parkinson's disease is a chronic degenerative disease of the nervous system, accompanied by trembling of the arms and legs, impoverishment of movements and a gradual slowing of thought processes, and depression. Symptoms of the disease tend to get worse over time. There are no specific biomarkers and research methods that accurately confirm this pathology. Making a correct diagnosis from a specialist requires a long time to differentiate the disease from other diseases; as a result, the patient does not receive any therapeutic help, but is only in a state of searching for an answer for a long time. This review is devoted to optimizing research methods for Parkinson's disease by studying disorders in the voice-speech apparatus of patients, through questioning with the "Voice handicap index" questionnaire. This method represents a promising area of research for further understanding the pathophysiology of the disease and offers potential for use as an early diagnostic marker in disease progression.

Keywords Parkinson's disease, Speech disorders, Voice changes, "Voice handicap index" questionnaire

1. Introduction

Parkinson's disease (PD) - is a global health problem whose prevalence is expected to double from 6.2 million cases in 2015 to 12.9 million cases by 2040 [3]. Parkinson's disease is a chronic progressive neurodegenerative disease, the main clinical symptoms of which are motor (hypokinesia, muscle rigidity, resting tremor and postural disorders - inability to maintain balance when changing posture) and non-motor (autonomic affective, cognitive, sensory) disorders [4]. At the intersection of motor and non-motor manifestations there are speech disorders, the frequency of which, depending on the classification and diagnostic methods, in people with Parkinson's disease reaches 89% [1,5,7]. Patients with Parkinson's disease have a characteristic voice: it is monotonous and may have hoarseness. [7]. Patients often have difficulty initiating speech, speak in short bursts of words, remain inappropriately silent, exhibit variability in speech rate, and may have vibration in the voice [7,9].

Speech disorders in PD are manifested by changes in articulation, changes in voice and fluency of speech. Patients with PD complain of decreased clarity of pronunciation and

decreased fluency of speech with frequent stops, and changes in voice strength. depends on four processes: 1) formation of an air stream; 2) the process of phonation; 3) the process of articulation; 4) air wave propagation.

A speech disorder is a disorder of any of these interrelated components. Rigidity of the respiratory muscles in patients with PD, a decrease in the volume of the chest leads to a more reduced air flow passing through the vocal tracts, causing a muffled, weak voice. Stretching of the vocal folds and insufficient closure leads to hoarseness and decreased sonority. Rigidity of the vocal muscles leads to monotony. Rigidity of the muscles of the tongue and lips leads to impaired articulation and dysarthria, slurred speech. Also in the spectrum of speech disorders are involuntary pauses, difficulties initiating speech, short episodes of acceleration, obsessive repetitions of syllables and words (palilalia).

Over 90% of patients with PD report low voice intensity and poor quality of communication, leading to a sharp deterioration in vital activity and social isolation. In turn, sensorimotor dysfunction, distorted perception of voice volume and sensory processing disorders are the cause of impaired speech production by the presence of muffled speech and decreased vocal strength. Patients rate the volume of their own speech when speaking higher than they should, perceiving it as natural, and the communication of others is like screaming.

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To provide timely assistance and reduce the rate of development of the disease, the essential importance of early identification of speech disorders is realized through instrumental diagnostic methods (laryngoscopy, glottography and myography, measurement of the time of maximum phonation, study of the act of swallowing and others); involving the acoustic study of verbal construction with the possibility of transforming a number of subtle changes in speech; as well as individual approaches such as the use of specialized scales for assessing the transparency of dysarthric speech, vocal range, the generally accepted rating system for PD, and a self-diagnosis scale for speech disorders. [2]. Within the framework of phonetic and linguistic tests, voice and speech tests differ in the Voice Handicap Index, which focuses on the impact of speech impairment on the patient's health.

B. Jacobson et al. in 1997 created the Voice handicap index questionnaire, an English phrase meaning “voice disorder index” [8]. The Voice Impairment Index (VHI) is a common questionnaire used for a wide range of voice disorders, and it is the most applicable subjective self-report questionnaire to patients who have a perceived voice impairment. It shows the impact of disability caused by voice impairment on quality of life (QoL). It can be used as a tool for perceptual analysis of voice quality, which shows us the impact of voice problems on the quality of life of patients with various voice and speech pathologies. As with other neurodegenerative diseases, the severity of PD progresses over time, so timely preventive measurement of its severity from the vocal apparatus is a relevant topic for dynamic assessment of the quality of life of patients with Parkinson's disease. This Questionnaire consists of 30 statements, classified into three categories of 10 statements each. Category P indicates physical disorders that arise in the patient and are caused by voice disorders, category F indicates functional disorders, category E indicates emotional disorders. Each of the statements in the questionnaire is assessed on a point system from 0 to 4. The sum of points determines the severity of these disorders. The maximum scale is 120 points. According to B. Jacobson et al., a VHI exceeding 60 points corresponds to significant disturbances in quality of life, and 40–60 points corresponds to a disorder of moderate severity. A score of less than 40 indicates mild impairment.

Specifically, the following statements apply to Category P: “When I speak, I feel like I'm running out of air,” “The timbre of my voice changes throughout the day,” “My voice is raspy and I'm always thirsty,” “I try harder.” effort to talk,” etc. Typical representatives of category F statements are: “My voice is difficult for others to understand,” “My voice disrupts the quality of my personal and social life,” “I talk on the phone less than I want,” etc. Category E includes statements such as: “I find that people do not understand me because of problems in my voice,” “People are annoyed by my voice,” etc. [10].

Today, the diagnosis of voice disorders is also important as a non-invasive method for the premature detection of PD, since about 90% of patients with PD are susceptible to

dysphonia, which is how they differ from healthy people [6]. Thus, diagnosing PD using voice disorders is one of the most promising and effective methods. Thanks to this, the assessment of voice disorders in patients with PD provides dynamic indicators of the quality of life of patients and an assessment of the “depth” of the disease, and also plays an important role in screening for PD. In the early stages of PD, voice impairment is not indistinguishable to the listener, but it can be distinguished by analyzing this questionnaire. In this regard, it is important for early detection at different stages of timely diagnosis by medical workers and to provide medical assistance at the right time. Currently, there are no validated biomarkers that can provide effective early diagnosis of PD. As a result, there is an urgent need for the prospective use of the “Voice handicap index” questionnaire, which is the first link in identifying various kinds of disorders both in the quality of life and in the emotional, physical and functional state of the patient.

Early detection of PD is an important factor for timely diagnosis and management of this disease. The current diagnostic method consists of many tests, as well as specialized studies, which can be time-consuming and expensive. This study presents a new method for early diagnosis by analyzing voice disorders in relation to the development of PD. Researchers study a set of characteristic data in the questionnaires of individuals in this group, and depending on the results, they refer them to the right examination and to the right specialist in order to further analyze and compare cases of Parkinson's disease and healthy people.

Differentiated diagnosis of diseases whose symptoms are intertwined with PD contributes to complex treatment, both therapeutic and pharmacotherapy. Developing and implementing joint diagnostic and treatment tactics of an otolaryngologist, a neurologist and a psychologist undoubtedly helps to increase the effectiveness of treatment and prevention of not only neurological diseases, but also pathologies closely related to them in phoniatrics. However, this problem requires detailed study.

Thus, a comprehensive assessment of therapy in combination with speech rehabilitation provides stable results. Coping with speech impairment should involve an interdisciplinary approach to the management of patients with PD.

2. Conclusions

In conclusion, research on various diagnostic methods in disease recognition, used as feature selection and feature reduction techniques, is of significant importance for various fields. In diagnosing Parkinson's disease, this method will help identify the most informative characteristics for early diagnosis. However, to ensure the reliability of the results, the issues and critical issues associated with the selection of key questionnaire items need to be carefully considered.

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