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THE EFFECT OF PROGRESSION OF PARKINSON'S DISEASE ON SWALLOWING AND VOICE

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ABSTRACT

Background: Parkinson's disease is a progressive neurological disorder which affects many systems of the Human Body including Voice and Swallowing systems. Many patients are not even aware of the deterioration occurring in their body due to the progressing Parkinson's disease.

Objective: To find out the effect of Progression of Parkinson's disease on Swallowing and Voice

Methods: A Cross-Sectional study was conducted using Non-Probability convenience sampling technique in 4 Hospitals of Multan. A sample of 172 Parkinson's patients were enrolled into the study by their informed consent. After filling the Demographic sheet, Patients were given three Questionnaires of Mini Mental Scale Examination (MMSE), Voice Handicap Index and Dysphagia Handicap Index in order to rate the handicapping effects of Parkinson's disease duration on their Voice and Swallowing. Data Analysis was done by using SPSS 21.0 statistical software.

Results: The results of the study showed significant impact of Parkinson's disease duration on Voice. The physical and Functional parameters of Voice Handicap Index are significantly affected. The results showed that emotional parameter of Dysphagia handicap index is significantly affected by disease duration. It also showed the positive correlation of VHI and DHI measurements in PD duration groups.

Conclusion: The results of the study concludes that increasing duration of Parkinson's Disease affect the Voice significantly than Swallowing. It will help in determining the Voice and Swallowing related bodily changes like Silent Aspiration, Vocal fold paralysis etc. of patients with increasing duration of Parkinson's disease. Hence it will help in making better treatment plan for these patients.

Keywords: Parkinson's disease, Disease Duration, Voice, dysphagia, Voice Handicap Index, Dysphagia Handicap Index

INTRODUCTION

Parkinson's disease (PD) is a chronic neurodegenerative condition marked by a progressive reduction in the population of neurons in the brain responsible for dopamine production (1, 2). The pathogenesis of Parkinson's disease (PD) is defined by the degeneration of dopaminergic nerve cells with the accumulation of α-synuclein (α-syn)-containing protein clusters, referred to as Lewy bodies (LBs) and Lewy neurites(3). The pathology of Parkinson's disease remains incompletely elucidated, as its prevalence escalating with age, influenced significantly by genetic and environmental variables in its initiation and advancement. Significant progress has been achieved in the genetic dimensions of Parkinson's disease due to the swift advancement of genetic testing technologies (4). As of now, variations in over 20 genes and more than 90 prevalent genetic risk loci have been discovered shown as related with Parkinson's disease (5, 6). The most typical signs indicative of Parkinson's Disease (PD) involve bradykinesia, uncontrolled muscle contractions, alterations in spoken language and writing skills, diminished automatic movements, and persistent tremors in specific body regions. While there is no treatment for Parkinson's disease, many clinical procedures have been established to assess the extent and duration of an individual's condition, therefore enhancing the standards living for those with Parkinson disease (7).

Speech and swallowing difficulties are anticipated to affect up to 95% of people with Parkinson's Disease (PWPD) over the whole duration of the illness (8). A combined set of sensorimotor and executive function deficiencies likely contributes to these abnormalities (9). The capacity of PWPD to detect the existence and intensity of these swallowing and speaking abnormalities seems to be compromised as well. Several investigations have demonstrated that individuals with Parkinson's disease possess a difficulty to recognize or rectify speech impairments (10) and a diminished capacity to notice swallowing difficulties (11). A restricted assortment of studies indicates that the capacity of PWPD to detect alterations in speech as well as swallowing is affected within the early stages of illness development. Existing literature indicates conversations problems manifest promptly and represent a number of prominent abnormalities in individuals with Parkinson's disease, irrespective of illness phase or tenure(12). In a research, almost 40% of individuals with Parkinson's disease reported alterations in swallowing functioning, that had correlations with perforation and inhalation. The research further emphasized the correlation between between speech and vocal deficits and swallowing difficulties (13).

The central and peripheral effects of Parkinson's disease significantly compromise ingestion, resulting in dysphagia. The biological attributes of dysphagia in Parkinson's disease can affect every phase of swallowing, particularly the pharyngeal phase, where ingestion duration is marked by hypokinesia, resulting in laryngeal permeation and/or inhalation in a significant proportion throughout the disease's degenerative progression(14). The neurological disease causing hypokinesia is thought to be associated with a broader neurodegenerative mechanism linked to aberrant alpha-synuclein protein accumulation in both motor and non-motor central and peripheral neurons, identified at death by the presence of Lewy neurites and Lewy bodies (15). The establishment of Lewy degeneration is believed to start at least 10 years before the emergence of significant motor deficits, referred to as the “preclinical” or “premotor” phase of Parkinson's disease (16). Speech and swallowing problems may occur within the primary non-advanced phases of Parkinson's disease, however there is inconsistency among existing literature about this observation. The development frequency of deterioration in brain circuits governing speech and swallowing may be affected by the age of Parkinson's disease beginning, with subsequent onset (e.g., > 70 years) correlated with greater motor and non-motor clinical manifestations when compared to initial development (17). Nonetheless, this assumption had been refuted by new research about the magnitude of both speech and swallowing abnormalities (11, 18).

The purpose of this research is to assess how Parkinson’s disease exacerbation influences swallowing and voice in order to understand the negative influence on their quality of life as well as the occurrence of potentially fatal problems like aspiration pneumonia. The study aims at determining the relationship between the duration of PD and vocal dysfunction as measured by the voice handicap index (VHI), and dysphagia as measured by the dysphagia handicap index (DHI). Furthermore, it plans to establish the interaction between voice and swallowing dysfunction in terms of VHI and DHI test results. These findings will be of significance in understanding the changes in the pathoanatomy of Parkinson’s disease, and to facilitate the provision of appropriate, coordinated, and professional care protocols to patients for enhanced quality of care.

METHODOLOGY

Sample selection

The study included 172 patients diagnosed with Parkinson's disease, selected using a non-probability convenience sampling technique. Both male and female participants were enrolled if they did not have any cognitive deficits and had been clinically diagnosed with idiopathic or acquired Parkinsonism. Those with any other diseases for example hypertension disorder, depression, dementia or Alhazimer's disease were also excluded. The sample was selected conveniently from Ibn-e-Sina Hospital, Nishter Hospital, City Hospital and Khawaja Farid Hospital Multan during six months.

DATA COLLECTION TOOL

Demographic sheet: It included patient's name, gender, age disease duration, marital status, type of Parkinson's disease

Mini-Mental State Examination(MMSE): It is a 30-item survey frequently utilized in therapeutic and research contexts to assess cognitive dysfunction.

Dysphagia Handicap Index (DHI): This is a verified and established 25-item English survey which delineates the debilitating impact of dysphagia on the emotional, functional, and physical dimensions of the person's living.

Voice Handicap Index (VHI): This is a 30-item survey designed to assess the functioning, physiological, and emotional effects of a voice issue on an individual's standard of life.

DATA COLLECTION PROCEDURE

Patients of Parkinson were recruited using the Convenience Sampling technique from the above-mentioned study settings after seeking permission from their authorities. Data was collected from Ibn-e-Sina Hospital Multan, Nishter Hospital, City Hospital, Khawaja Farid Hospital Multan. The VHI and DHI identify physical, emotional, and functional handicapping effects of voice and swallowing. MMSE will determine the Cognitive function of these patients. Patients with moderate and Severe degree of impairment on MMSE will not be recruited. Only patients with Mild impairment will be taken. These tools will assist in assessing the Physical, Emotional and Functional aspects of Quality of Life of Parkinson Patients with disease progression. After taking Consent from the participants, Questionnaires were filled from 172 patients and the results were

studied to check the correlation between duration of PD and VHI, correlation between duration of PD and DHI and correlation between duration of VHI and DHI.

DATA ANALYSIS PROCEDURE

The data was analyzed by using the SSPS 21.0 statistical software. Three tests chi-square test, Wilcoxon two sample test and Kruskal -Wallis one-way are applied to find out the results.

RESULTS

Among the 172 participants recruited in this study, 109 (63.3%) were male while 63 (36.7%) were female. The mean age of the study participants was 55.2±8.5 years. The 113 (65%) participants of our study were married. 120 (69.7%) patients enrolled in our study had Idiopathic type of Parkinson's' disease. According to self-severity scale, 71 (41.4%) patients reported no dysphagia, 60 (34.8%) reported moderate degree of difficulty in swallowing and 41 (23.8%) reported severe degree of dysphagia in our study. The clinical severity categories of dysphagia according to their subscales is provided in Table 1. The mean Minimal Mental State Examination Score was 26.2±3.2 All the patients in our study had No cognitive impairment. There were 86 (50%) of the participants in the shortest PD duration (0-4) years, 35 (20.3%) of participants in the medium PD duration (5-9 years) and 51 (29.7%) in the longest (>10 years) duration groups.

Table 1: Demographics of participants

Category	*Value*
Total Participants	172
Gender	
Male	109 (63.3%)
Female	63 (36.7%)
Mean Age (years)	55.2 ± 8.5
Marital Status	
Married	113 (65%)
Unmarried	59 (35%)
Parkinsonism Type	
Idiopathic	120 (69.7%)
Secondary	52 (30.3%)
Mean Minimal Mental State Examination Score (MMSE)	26.2 ± 3.2

No significant difference for Dysphagia Handicap Index subscales and self-severity score was observed while comparing all the three Parkinson's disease duration groups except for Emotional subscale of DHI which had a significant difference between shortest duration (0-4 years) and Longest duration (>10 years) as well as between medium duration (5-9 years) and longest

duration (>10 years) groups. The longest duration group (>10 years) had a higher means for Total DHI score as well as self-severity score of dysphagia. A significant difference was found between shortest (0-4 years) vs medium (5-9 years) group and shortest (0-4 years) vs longest (>10 years) for physical subscale of DHI. Similarly, Difference between shortest (0-4 years) vs longest (>10 years) and medium (5-9 years) group vs longest (>10 years) was also observed in our study. The longest duration group (>10 years) had a higher means for Total VHI score as well as a significantly greater percentage of severe Voice Handicapped patients ($p<0.001$) as shown in Table 2.

Table 2: Summary of Dysphagia and Voice Handicap Index (DHI and VHI) Scores Across Parkinson's Disease Duration

Variable	*0-4 years (n=86)*	*5-9 years (n=35)*	*>10 years (n=51)*	*p-value*	*Significant Pairwise Comparisons*
Dysphagia Handicap Index (DHI)					
Emotional Subscale	3.0 ± 4.4	3.4 ± 4.4	3.9 ± 3.8	0.031**	0-4 vs >10, 5-9 vs >10
Functional Subscale	2.5 ± 3.5	1.7 ± 2.1	2.7 ± 2.7	0.524	-
Physical Subscale	4.8 ± 3.6	4.0 ± 2.9	4.4 ± 2.9	0.715	-
Total DHI Score	10.3 ± 10.7	9.2 ± 7.7	11.2 ± 8.0	0.487	-
Voice Handicap Index (VHI)					
Emotional Subscale	31.8 ± 6.2	32.7 ± 6.4	33.8 ± 5.1	0.223	-
Functional Subscale	29.1 ± 5.5	30.8 ± 4.3	34.5 ± 5.2	0.001***	0-4 vs >10, 5-9 vs >10
Physical Subscale	30.7 ± 6.7	34.6 ± 5.1	34.5 ± 5.2	<0.001***	0-4 vs >10, 5-9 vs >10
Total VHI Score	91.7 ±	98.1 ±	101.2 ±	<0.001***	0-4 vs >10, 5-9 vs

	14.6	12.1	11.3	>10

DISCUSSION

Parkinson's disease is a prevalent and progressive neurological disorder which has no complete cure until now due to which it has caused a lot of stress in the society and among the patients of this disease. Patients of Parkinson's disease feels dependent and handicapped with increasing age due to the degenerative changes which occurred in their body. In this research 172 patients of Parkinson's disease were taken from four hospitals of Multan (Ibn-e-Sina Hospital, Nishter Hospital, City Hospital and Khawaja Fareed Hospital). After taking the informed consent, these patients filled their demographic profiles. According to the inclusion criteria Both male and Female patients were taken. Patients with both types (Idiopathic and secondary) were taken. The disease duration of patients was divided into three categories; 0-4 years, 5-9 years and 10+ years. In this study of 172 Parkinson patients, Patients with Idiopathic type of Parkinson were greater than the Secondary type. The male patients were more than the female ones. The married patients were more than the unmarried. The age range of patients was between 40 to 70 years. The results showed that Gender has no relation with the duration of disease and the patients with increased age has increased disease duration. The results of this study also showed the significant positive correlation between the VHI and DHI which is also revealed in the Latest research by Silbergleit et al. in 2021 (19).

The research conducted by Yeo et al. in 2024 demonstrated that the treatment group preserved swallowing activity, while the control group exhibited degradation, signifying notable time-dependent alterations in the Penetration-Aspiration Scale (PAS), National Institutes of Health-Swallowing Safety Scale (NIH-SSS), and VDS. The analysis of PAS and NIH-SSS liquid food ratings in both categories revealed substantial temporal impacts. Nonetheless, the treatment group demonstrated no substantial changes among the pre- and post-tests, suggesting the maintenance of ingesting ability (20). In comparison, our study found that the longest duration group (>10 years) had higher severity in swallowing dysfunction, particularly in the emotional and physical subscales of the DHI, indicating a progression of swallowing difficulties over time. A research by Zoë Thijs Christopher et al. (2020) on the perceptual features of hypokinetic dysarthria in the patients of Parkinson's disease revealed that patients within the course of PD

have Breathy, dysphonic and rough voice . This research also supported the results by giving the significant readings of Physical subscale on VHI(21).

A research by Alice K. Silbergleit et al. (2021) studied the handicapping effects of dysphagia and dysphonia among the patients of PD in the course of disease duration. A sample of 277 PD patients were taken in this study to look upon the degenerative changes occurring in their body and how these patients self-perceived about it. VHI and DHI was used in this study which showed the positive correlation with the disease duration. This study also strongly supported that there is a positive correlation of voice and swallowing disorder in PD patients with increasing duration. Spearman's correlation is used for this data which is not normally distributed. It also supported the conclusion that all the three subscales (physical, functional and emotional) of VHI and DHI showed handicapping effects with the duration of disease although it did not specified that which subscale gets more affected (19).

CONCLUSION

On the Basis of results, it was concluded that there was a positive correlation of PD duration with VHI (significant effect on Physical and Functional subscale). It was also found that there was a positive correlation of PD duration with DHI (significant effect only on Emotional subscale) and a positive correlation between duration of VHI and DHI. Future researches can be conducted to help in letting these patients know about the silent changes which occur in their body leading to life-threatening condition like Silent Aspiration.

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