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# Relation between Voice Handicap Index (VHI) and disease severity in Iranian patients with Parkinson's disease

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## Abstract

**Background**: One third of patients with Parkinson's disease (PD) have mentioned "dysphonia" as their most debilitating communication deficit. Patient-based measurements, such as Voice Handicap Index (VHI) add necessary supplementary information to clinical and physiological assessment. There are a few studies about relation between VHI and disease severity in PD, although none of them showed any significant correlation. The goal of this study was to find correlation between these variables in Iranian PD patients.

**Method:** This cross-sectional, analytical and non-interventional study was done on 23 PD patients who reported a voice disorder related to their disease. They were selected from attendants of movement disorders clinic of Hazrat Rasool Akram Hospital. The relationship between disease severity (according to Hoehn and Yahr/H&Y and Unified Parkinson's Disease Rating Scale-part3 /UPDRS-III) and VHI questionnaire (and its 3 domains) was investigated based on patients' sex, UPDRS-III score H&Y and VHI.

**Results:** Total VHI and its 3 domains had no relationship with disease severity (H&Y) in all patients and by sex separation. However, there was a positive correlation between VHI and disease severity (UPDRS-III) ($r$=0.485). There was also a relation between physical and functional domains of VHI and UPDRS ($r_P$=0.530, $r_F$=0.479) while no relationship observed regarding sex differences. 9 out of 18 UPDRS-III items had strong relationship with VHI (total and 3subscales).

**Conclusion:** Iranian PD patients feel handicap according to voice disorder caused by PD. Patient satisfaction of voice decreases with the disease severity and progression. A larger sample size is necessary to find relationship in genders. VHI is an important issue could be offered to be used in PD beside other assessments

**Keywords:** Parkinson's disease, Disease severity, Voice, VHI, Quality of life.

## Introduction

Parkinson's disease (PD) is the second common neurodegenerative disease in the world, after Alzheimer's disease (1). It is caused by gradual death of many neuronal systems specially dopaminergic neurons in substantia nigra pars compacta (2-4). The most important risk factor of PD is "age" (5, 6). By increasing of age, the prevalence of

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PD is growing. There is 3:2 ratio of males to females (2). PD results in hypokinetic dysarthria that affects all aspects of speech such as respiration, phonation, articulation and prosody (7, 8). Nearly 90% of patients have oral communication disorders (9) but "voice" is affected more and sooner than other speech subsystems (10-12). One third of Parkinson patients suffer from dysphonia and they present breathy and harsh voice as their most debilitating deficit (13). Voice disorders consist of several different aspects, therefore several measurements and scales should be used (14). Clinical evaluation of voice includes perceptual, acoustic, (video) laryngosteroboscopic and aerodynamic assessments (14-16) that are very useful in clinical evaluation of neurological disorders (15, 17). Neither voice objective scales such as video/ auditory nor perceptual assessment can evaluate the amount of handicap that a patient experiences as a result of voice disorder. Patient-based measurements can add some necessary supplementary information to biological and physiological data that are associated with voice disorder (17, 18).

Voice Handicap Index (VHI) is a common questionnaire used in a wide range of voice disorders and it is the most applicable subjective self-rating questionnaire in patients who have perceived voice disability. It shows the effect of disabilities resulting from voice handicap on quality of life (QOL) (15, 16). VHI is a perceptual analysis tool of voice quality that shows us the influence of voice problems and their treatments on patients QOL (19).

Like other neurodegenerative disorders the severity of the PD progresses over the time (20, 21). There are several ways to assess motor performance and disease severity in PD. The Unified Parkinson's Disease Rating Scale(UPDRS) is the most common tool for clinical evaluation of PD (2) and measures motor and some of non-motor symptoms of PD. The 3rd part of the test (UPDRS-III) evaluates all fundamental motor characteristics of PD (22). In present research, movement disorder society (MDS-UPDRS) version of the test has been used. Hoehn and Yahr (H&Y) is another scale for PD's severity that rates between 0-5 based on the level of clinical disabilities (23). There is no study about VHI in Iranian PD's patients; and therefore no research about any relation between PD's motor disabilities and voice disorder. Due to increase in Iranian aged population in future decades, PD prevalence will increase as well (24), and necessity of these kinds of studies are obvious. Several studies express VHI progression in PD and suggest the effective role of VHI in determination of voice disorder influence on PD's quality of life (25-27). The only research about relation between movement disabilities and VHI in PD under pharmacologic therapy is a study by Midi et al(28). It hasn't found any correlation between VHI and disease severity (UPDRS-III). Frost et al(25) did not find any relation between VHI and UPDRS in patients under surgical therapy (Deep-Brain Stimulation of the Subthalamic Nucleus /STN-DBS). The purpose of this study is to examine correlations between disease severity and handicap due to voice disorder; and whether the VHI score increases with the increase of disease severity, and also the relation between VHI domains (Physical, functional, emotional) and disease severity. Some objective and subjective studies in PD have been reported several different items by sex (29-31) and some findings have suggested that certain speech characteristics are different in male and females (32-37). Hence the role of sex and probable differences (in PD voice handicap index) based on sexuality was another purpose of this study.

## Methods

This cross-sectional, analytical and non-interventional study was carried out on 23 PD patients who were chosen from attendants of movement disorders clinic of Rasool Akram Hospital, from January until June of 2011. Tehran University of Medical Sciences ethics committee approved the study and all of patients signed the consent form. Their demographic characteristics (table 1) and drug information were recorded. All of participants used levodopa as the main drug.

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Table1. Basic characteristics of patients with Parkinson's disease.

| Variables | Male(13) | Female(10) | Total(23) |
|---|---|---|---|
| Age | 63.23±8.64 | 59.1±7.76 | 61.435±8.26 |
| Duration of disease | 8.538±4.858 | 11.2±8.189 | 9.696±6.49 |
| Disease severity(H&Y) | 2.08±0.277 | 2.30±0.483 | 2.17±0.388 |
| Disease severity (UPDRS-III) | 31.08±14.511 | 32.90±12.378 | 31.87±13.35 |

H&Y: Hoehn and Yahr Scale, UPDRS: Unified Parkinson's Disease Rating Scale

Table 2. Means, standard deviation (SD) and P-values of VHI and 3domains scores

| Variables | Male(13) | Female(10) | p-value | Total(23) |
|---|---|---|---|---|
| VHI-total | 42.85±28.032 | 32.20±24.621 | 0.345 | 38.22±26.565 |
| VHI-P | 13.77±8.662 | 10.80±7.300 | 0.383 | 12.48±8.06 |
| VHI-F | 16.69±10.443 | 13±10.435 | 0.411 | 15.09±10.37 |
| VHI-E | 12.38±9.870 | 8.40±8.316 | 0.306 | 10.65±9.247 |

VHI: Voice Handicap Index, VHI-P: VHI Physical, VHI-F: VHI Functional, VHI-E: VHI *Emotional*

N-Methyl-D-Aspartate (NMDA) antagonists, dopamine agonist, Benzodiazpines and Selective serotonin reuptake inhibitors (SSRIs) have been among most used medications by patients. Patients pharmacotherapy, at least in recent year was under supervision of a movement disorders specialist (Shahidi). To avoid scoring bias, another neurologist expert in UPDRS scoring, participated in this research (Karkheiran). For patient selection, U.K Parkinson's Disease Society Brain Bank's clinical criteria utilized in diagnosis of probable Parkinson's disease have been used. Exclusion criteria were: suffering from another neurological or movement disorders, ages younger than 50 years, levodopa therapy under 3 month, disease onset less than 5 years (for differential diagnosis of PD from other Parkinsonism disorders) (38) and have speech therapy.

Implementation of tests was done in speech therapy department of Tehran University of Medical Sciences. None of examiners know about test results of each other. All of participants have been examined 45-90 minutes after taking the drugs so they were in the "on" state. At first, patients were evaluated according to UPDRS-III (Karkheiran), then 5-10 minutes after finishing UPDRS test, patients answered VHI questionnaire. A Speech and language pathologist was beside patients for any guide or help. To avoid fatigue and psychiatric symptoms of PD, VHI questionnaire have been taken in "on" period.

*Disease severity*

The part 3 of UPDRS is used for determination of disease severity. UPDRS-III consist of 18 cardinal items and according to Likert rating scale, the total score is between 0-132. Since the first item of UPDRS-III is "speech" which is so important, its scores have been analyzed individually. At the end of UPDRS-III, H&Y score (another clinical disease severity scale) has been recorded too. The UPDRS-III accomplishment for every single patient takes approximately 15 minutes. Final scores were obtained via recording every stage of this test and matching all items with the educational film was published by movement disorder society.

*Voice Handicap Index*

After filling VHI questionnaire by patients, its total score and 3 related domains (Physical, Functional, and Emotional) were computed separately (Table 2).

*Statistical analysis*

The SPSS 18.0.0 software package was used for statistical analysis. Kolmogorov–Smirnov test used to determine variables normality. Pearson and Spearman correlation coefficient was used to examine the relation between total score of UPDRS, its 18 items, VHI total score and its 3 related domains. $\chi 2$ (for sex equality) and independent sample t-test (for compare variables means between males and females) were used with the Confidence Interval of 95% ($p<0.05$).



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Table 3. Correlation between VHI (and domains), disease severity, disease duration, speech (item of UPDRS)

| parameters | Severity(UPDRS) | | | Severity(H&Y) | | | Duration of disease | | | Speech | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Male | Female | total | Male | female | total | Male | Female | total | Male | Female | total |
| VHI-T | 0.473 | 0.579 | 0.485' | 0.464 | 0.266 | 0.260 | 0.613' | 0.251 | 0.342 | 0.628' | 0.554 | 0.612" |
| VHI-P | 0.520 | 0.616 | 0.530" | 0.465 | 0.152 | 0.234 | 0.512 | 0.244 | 0.300 | 0.448 | 0.455 | 0.469' |
| VHI-F | 0.506 | 0.496 | 0.479' | 0.464 | 0.344 | 0.294 | 0.616' | 0.338 | 0.391 | 0.632' | 0.716' | 0.661" |
| VHI-E | 0.351 | 0.552 | 0.395 | 0.467 | 0.038 | 0.139 | 0.638' | 0.105 | 0.281 | 0.706" | 0.451 | 0.624" |

VHI-T: VHI Total, VHI-P: VHI physical, VHI-F: VHI Functional, VHI-E: VHI Emotional

': Correlation is significant at the 0.05 level (2-tailed)

": Correlation is significant at the 0.01 level (2-tailed)

## Results

This study was done on 23 PD patients reported voice disorder due to their disease. The relationship between disease severity (according to H&Y and UPDRS-III) and VHI questionnaire (and its 3 domains) was investigated. Minimum and maximum scores of UPDRS-III and H&Y were 11-69 and 2-3. Mean VHI scores (total and all of 3 domains) of males were higher than females (Table 2), however significant difference was not observed (Table 2, p-values).

*Relation between VHI and disease severity*:

Based on H&Y (r=0.260), there was not any relationship between VHI score and disease severity. The same result observed in both sex (Table 3). A positive correlation was found between total VHI (VHI-T) score and disease severity, according to UPDRS-III (r=0.485). However, no relation was observed between these two variables in males and females (Table 3). There was not any relationship between VHI domains scores (Physical, Functional, Emotional) and H&Y scale, in all of patients and by sex segregation. There were positive correlations between VHI physical and functional scores; and UPDRS-III in all participants ($r_P$=0.530, $r_F$ = 0.479) but no sex-related correlation was present.

*Relation between VHI and motor dysfunction:*

In present study the relationship between UPDRS-III subscales (18 items represented patient motor performance) and VHI score (total and 3 domains) was investigated. The aim of this activity was to evaluate possible relations between motor disabilities, especially speech (Table 3) recorded by sex and VHI in all patients and in both sexes separately. 9 UPDRS-III items had correlation with VHI-T scores and its 3 domains (Table 4). The VHI-T scores (r=0.612) and domains had a positive relation with "speech" item. In males group, VHI-T scores (r=0.628), functional and emotional domains had correlation with speech item ($r_F$=0.632, $r_E$ =0.706) but in females just functional domain showed significant relation with speech item (r=0.716).

*Relation between VHI and disease duration:*

There was no correlation between VHI-T score and duration of disease in patients(r=0.342) (Table 3) but VHI-T had a correlation with disease duration in male sub group (r=0.613). Functional and emotional VHI domains showed relationship with duration of disease in males also.

## Discussion

PD is a movement disorder that causes Hypokinetic dysarthria and affects all of speech aspects including "voice". All of participants in present study reported voice difficulties. Although the males group was reported more voice handicap (resulted from PD) than females, but no statistical difference was found between two groups, similar to other research (39).

It is known that increases in movement disorder severity affect the speech subsystems like "voice". Current study confirms this phenomenon. The VHI-T cut off point in Iranian patients suffering from voice disorders was "14.5" (40); in this research, the mean VHI_T was "38.22" which suggested that PD patients QOL (based on voice handicap) were out of normal range. The positive correlation between VHI_T, physical and



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Table 4. significant correlation between VHI (and domains) and motor examination factors of UPDRS-III

| Variables | VHI-P | VHI-F | VHI-E | VHI-T |
|---|---|---|---|---|
| Speech | 0.469 | 0.661 | 0.624 | 0.612 |
| Facial expression | 0.475 | 0.516 | 0.435 | 0.513 |
| Leg agility | 0.534 | 0.565 | 0.611 | 0.603 |
| Arising from chair | 0.464 | 0.292 | 0.273 | 0.357 |
| Gait | 0.784 | 0.693 | 0.739 | 0.753 |
| Posture | 0.528 | 0.409 | 0.475 | 0.493 |
| Spontaneity of movement(body bradykinesia) | 0.739 | 0.616 | 0.701 | 0.709 |
| Rest tremor amplitude | 0.506 | 0.464 | 0.487 | 0.481 |
| Constancy of rest tremor | 0.493 | 0.400 | 0.425 | 0.433 |

VHI-P: VHI physical, VHI-F: VHI Functional, VHI-E: VHI Emotional, VHI-T: VHI Total
Correlation is significant at the 0.05 level (2-tailed)

functional scores and disease severity (UPDRS-III) imply that patient's perception of handicap resulted from voice disorder gets worse with increasing of disease severity. Midi (28) did not find any relation between UPDRS and VHI-T. That is why the participants in his study were in their first 5 years of disease and therefore, their motor impairment severity was mild. But, in present study, minimum duration of disease was 5 years and severity range included mild to severe (UPDRS 11-69). Not finding a relation between VHI-T and disease severity (H&Y) may be due to lower H&Y sensitivity and accuracy rather than UPDRS.

Speech item (first UPDRS item) has strong relation with VHI scores (table4). This finding shows patient perception of voice situation is consistent with clinical scores determined by neurologist (by motor assessment). The interesting issue is the positive correlation between 9 items of UPDRS and VHI (total and subscales scores). In previous conducted studies (41), less and weaker relations between speech characteristics and UPDRS were observed. This may suggest an accurate and important patient viewpoint about voice disorder and its handicap. "Signs and symptoms" are 2 terms that are frequently used in voice assessment. "Signs" are observable and testable voice characteristics but "symptoms" are the patient reports and complaints about voice problem (23). Patient based voice evaluation, like VHI, can help us to diagnosis and treatment of voice disorder.

Even though it was expected that the increase of VHI would be correlated with the disease duration, such result were not observed. There was a strong correlation between VHI-T, functional & emotional scores and duration of PD in males. A larger sample size may help to find these relations in females and all patients as a group.

## Conclusion

Iranian PD patients feel handicap due to voice disorder caused by PD and their quality of life was affected by voice impairment. Voice assessment, especially patient-based voice evaluation such as VHI, is an important offered issue used in PD beside other assessments. These kinds of studies can help us identify problems and treatment preferences.

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